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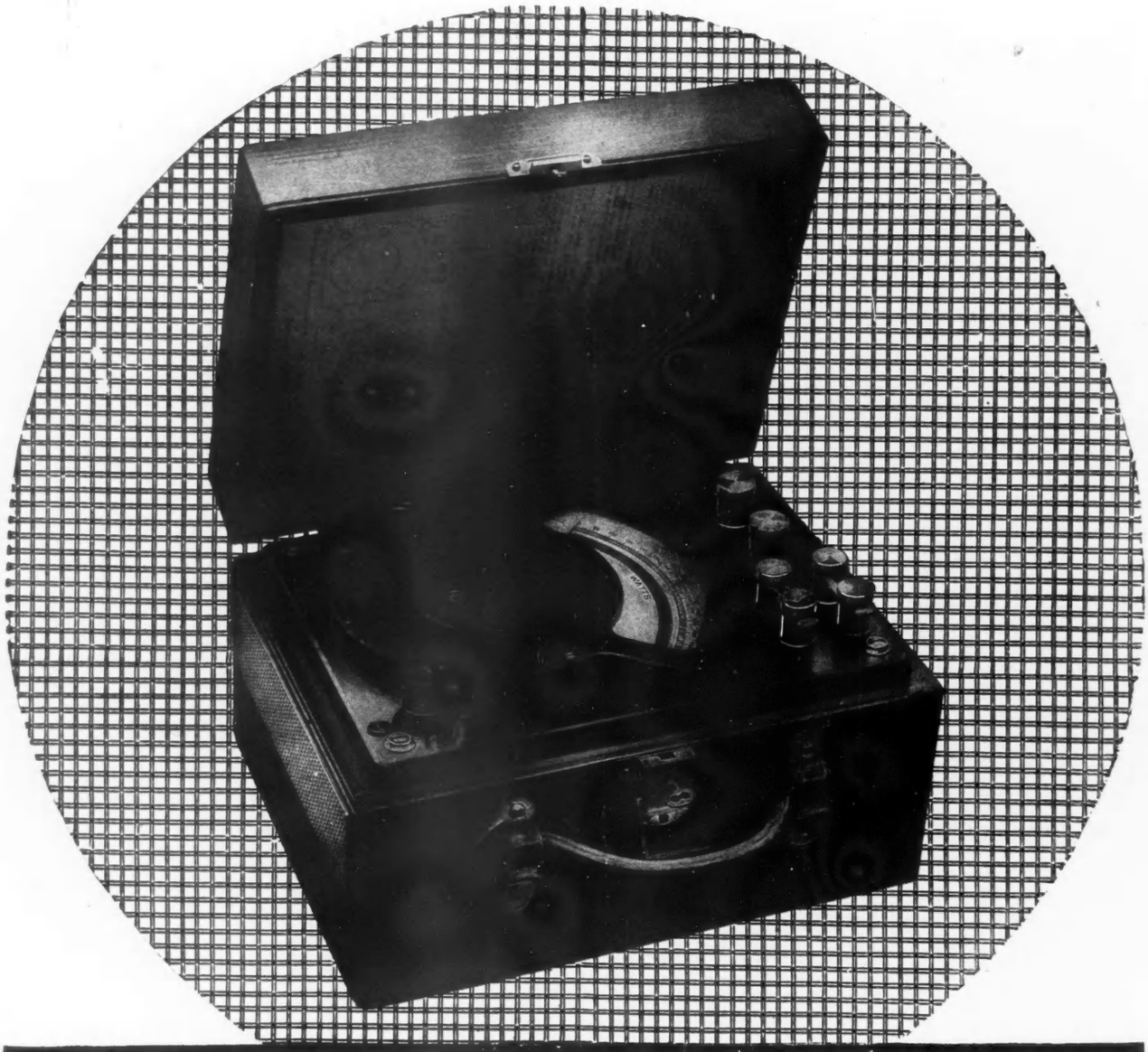

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Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

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Contents

Editorials 1065

The Modern Outdoor Substation 1068
By M. M. SAMUELS.
Apparatus Has Been Developed Until It Is as Reliable as Indoor Equipment, but Station Design Has Not Improved So Much—Notes on Transformers, Oil Circuit Breakers, Lightning Arresters, Air-Break Switches and Bus Supports.

Speeding up Manufacturing by Improving Illumination 1073
Actual Plant Tests Indicate 15 per Cent Increase in Production at Cost of 5 per Cent of Payroll—Equipment Found Relatively Inexpensive.

Attitude of Central Stations on Rates 1075
Questions Which Are Involved in War and Peace Adjustments of Rates to Meet Changed Economic Conditions—Duration of the Period of High Costs.

Calibration of Power-Factor Indicators 1076
By WALTER WESTCOTT HOKE.
Method of Calibrating Polyphase Power-Factor Indicators of Which the Resistances of the Potential Circuits Are Not Equal—Also Applies to Indicators in Which Current Coil Is in One Phase of a Two-Phase Line.

Central Station September Operations 1079
Based on Returns from 48 per Cent of the Industry, the Estimate for Entire Industry for Month of September Is: Revenue, $46,290,000; output, 2,712,000,000 Kw.-hr.

Conservation of Water Power in New England 1080
Benefits of Conserving Power Through Storage Developments Discussed Before Special Legislative Committee on Conservation of Resources.

Station and Operating Practice 1081

Central Station Service 1083

Technical Theory and Practice 1085

News of the Industry 1088

Associations and Societies 1097

Commission Rulings 1097

Current News Notes 1098

Recent Court Decisions 1098

Men of the Industry 1099

Trade and Market Conditions 1100

Current Prices of Electrical Supplies 1104

New Apparatus and Appliances 1106

Trade Notes 1107

Trade Publications 1107

New Incorporations 1107

Construction News 1108

Directory of Electrical Associations 1110

Record of Electrical Patents 1111

Advertising Indexes—Alphabetical, 145; Classified, 141-143; Searchlight Section, 38-62

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 72 New York, Saturday, December 7, 1918 *Number* 23

Looking to the Peace Conference

FROM now on all eyes will be turned in hope and confidence to the Paris peace conference. It is not longer a question of what individuals shall or shall not represent this nation, it is a question of what just reparation shall be imposed upon the enemy, what guiding righteous principles shall be laid down for the future of all the nations so that any more wanton onslaughts upon civilization shall be sure of defeat. The possible economic results of the conference upon generations yet unborn are limitless. They open a vista of new service for this country of energetic workers and vast resources. They may involve great responsibilities for this nation. Parties or individuals may seek to use them for selfish or unworthy advantage. But whatever changes or opportunities may be developed, we are sure that the great forces operating in the world are in the last analysis constructive for good, corrective of evil. The representatives of the countries that overthrew the mighty, unscrupulous strength of Germany will see to it that tangible benefits for humanity are written large and deep in the final agreement. And the terms therein set forth will give us a better understanding of what our place in the family of nations is to mean. We shall have to wait with patience.

Now that the emergency is past, decentralization of control is in order. Our state public service commissions are maintained at great expense and the commissioners would like to give service for value received. Various forms of federal control have given rise to questions of jurisdiction which lead to uncertainty and unrest.

The Presidential Viewpoint

HE WHO reads the President's message to Congress is likely to look for a clear-cut statement on the things which are the most vital to his every-day life and interest, the things which in his judgment mean most to the country. The Executive of the nation has another viewpoint; it is a different viewpoint, and we may take his message, what it says and what it leaves unsaid, as the only conclusion which he is prepared at the time to put before the nation. We wish that it had said more about reconstruction, we should like to have had more definite recommendations on domestic matters, but it must be admitted in fairness that the occupant of the White House is not the only man who is in doubt as to the wisest policy to be followed, whether the turn to the right or to the left will lead to the safer highway for travel. So we shall take the message as it is for such constructive light as we can see in it.

The policy on "reconstruction," we gather, is to let industry work out its own salvation. President Wilson regards the problem, so far as domestic affairs are concerned, as one "of economic and industrial readjustment." His statement that it is less serious for us than for the nations which have suffered more in the war bears out the general impression given by his message that he considers the world peace conference issues the most important now demanding his attention. He is therefore apparently content to leave both business and labor here to make their own arrangements. In fact, he well characterizes our people as knowing their own business, "quick and resourceful at every readjustment, definite in purpose and self-reliant in action." But those faculties are entitled to, they must have, free play so far as they are not used against the public interest. The difficulty is that whereas we have been operating under a rigid control for war reasons, we still are without sufficient knowledge as to exactly how long and in what degree that control will be retained. The President says that the restraints "are being relaxed as much as possible, and more and more as the weeks go by." This evidently means that the intent is that the government shall gradually abandon its use of the extraordinary powers granted for the war needs. Through this part of the message the Executive is hopeful that, as he says in so many words, it will not be easy to direct the return to a peace footing "any better than it will direct itself." If he is willing to leave the process to the "quick initiative" of the American business man, certainly the business man is willing now to have it so, provided of course there is no necessity for allocation of raw materials and capital. It is too late to make the advance studies which the European nations have in hand concerning their reconstruction problems.

Railroad policy is what causes the President the greatest concern. He has no "confident judgment" of his own, no judgment of any kind which he is ready to express. It is a large, serious question, big in itself, far-reaching in its effect upon other industries, upon our entire social and governmental structure. We cannot feel otherwise than that, having taken the railroads as a war measure, having used them in prosecuting the war to victory, the government is now bound to return them to their owners. It cannot justly return them in helpless operating or financial condition; it would not in the public interest put them back merely to the old unsatisfactory conditions of mixed restrictive regulation; it will surely have sooner or later a reasonable program for making the carriers more effective agencies in economical upbuilding of our industries. There is here an opportunity to learn from the mistakes of both war and peace in railroad management and

operation and to rehabilitate the carriers physically and financially and with sound economic results benefiting the nation.

It is right that President Wilson should pay tribute to the bravery of our armed forces, should emphasize the place they hold in our regard, should consider the need of providing places for them in industry when they return. These men will want, will be entitled to, work, and the plan of Secretary of the Interior Lane for land reclamation, with the resumption of public works of every sort, as recommended in the message, will help to meet this problem wisely. These processes of necessary construction and enlargement of production will aid in restoring the normal balance in industry which is essential for the payment of the heavy taxes of which the President gives warning. Congress may not have been told what it would like to have heard when the Executive stood before it, the members of the two houses may feel that they are asked to knead the dough while somebody else is eating the cake, but they can find in and outside of the Presidential document work to do which will measurably further the solution of some of our problems.

A report that one company showed the greatest output in its history on one day last week, due largely to the elimination of the daylight-saving hour, indicates that some results of this change are sure to be experienced in many properties during the present season. We are approaching the shortest day of the year, and the early twilight and winter conditions mean steady demand for energy for lighting.

Illumination and Industrial Efficiency

THE tests on industrial output as a function of illumination which are outlined in the paper by William A. Durgin presented at the recent convention of the Illuminating Engineering Society and abstracted in our columns this week are striking evidence of what good lighting really means. It is no easy matter to work out a series of practical tests of this character, and the Commonwealth Edison Company is greatly to be congratulated on its enterprise in going thoroughly into this exceedingly important subject. If all central stations were as keen on following up illuminating engineering matters, the average condition of artificial lighting would be immensely improved. When the tests outlined by Mr. Durgin are completed there will have been accumulated a mass of evidence so weighty as to leave no difference of opinion regarding the economic advantage of improved lighting.

A particularly useful part of the experiment is the comparison instituted between lighting at the minimum specified by the I. E. S. code and at the higher point that gives a maximum efficiency of production. There is no doubt in our minds that the code is altogether too lenient if it is to take into consideration at all the ultimate efficiency of the workman. Any one who will actually take the trouble to compare lighting at the code minimum with illumination pushed toward the upper limit of present good practice will quickly be convinced of the great gains which could be made. Of course, one may reasonably contend that a statutory code is intended merely to insure fair working conditions for the laborer, but does not the code fail of its duty to the laborer if it does not secure for him conditions of high industrial efficiency? It is not enough to be satisfied with the tolerable. The evidence secured in Chicago of increased output at a very small extra cost for illumination seems to be incontestable, and the facts should be closely studied by every progressive manufacturer who is on the watch to secure from his plant the biggest and best output of which it is capable.

Canada is not backward in making use of her resources. Vancouver, Calgary, Winnipeg, Toronto, Montreal, Quebec, every large city within her borders, is supplied with hydroelectric energy, because her government is keenly interested in water-power development. Will Washington please take notice?

Progress in Outdoor Substations

THE paper by M. M. Samuels which we present this week is of large practical value in summarizing the progress which has been made in the design and equipment of outdoor substations. This type of station has come to stay and has worked its way by its merits, beginning in places of fairly favorable climatic conditions and extending all over the country. The small outdoor substation presents a very easy problem, being merely an extension of pole-top equipment to a more substantial basis. The larger stations are only slowly coming to standard design, but very material progress has already been made. The outdoor transformers in particular have undergone material improvement, so that terminal troubles have been greatly reduced; self-cooled transformers have come into very general use, and all the accessory apparatus has been brought to more convenient and manageable form. With larger installations has come abandonment of the earlier elevated-platform type of construction, and recent designs carry the main weight on a concrete foundation and have a superstructure chiefly to carry conductors. Accessories like lightning arresters and choke coils are now designed for greater reliability and demand far less care and inspection than the earlier patterns.

The matter of switches and circuit breakers is still in a formative stage. Several types of air-break switches have come into successful use for plants of moderate capacity, but in Mr. Samuels' judgment still require considerable improvement. Oil switches and circuit breakers have long proved their reliability, but at the high voltages now in common use the cost and dimensions of these pieces of apparatus rapidly become extremely burdensome, especially at large outputs. It is perhaps not putting it too strongly to agree that there is considerable improvement still to be made both in switching apparatus and in the scheme of its application. At present in high-voltage stations and substations the switchboard is becoming an undesirably large factor of the total first cost and upkeep. Mr. Samuels calls especial attention to the matter of high-voltage conductors for outdoor substation work, and his judgment leans strongly toward the use of self-supporting conductors, preferably tubular, as against wires supported by strain insulators. Here as in many other cases the choice turns practically on the output and

voltage involved. With self-supporting busbars the steel work or other carrying structure may be relatively light, while any considerable system of wires held by strain insulators puts so large a burden on the supports that much greater strength, and hence greater cost, is demanded. All these things are gradually working themselves out experimentally. The designing engineer will find Mr. Samuels' suggestions and sketches of typical outdoor substations extremely useful as a guide to good current practice and a hint for further improvements.

Transition periods test staying power and make heavy draft upon reserve optimism. Temporary circumstances cannot shake fundamental stability, and a fair profit must be received upon honest effort and legitimate investment in supplying the necessities of civilization. Net earnings rather than prices are the real index of prosperity.

Electric Power in Sugar Mills

AS ELECTRICAL distribution becomes more general, so do new applications come to light to increase demand. It is only within five years that electric drive has been applied to plantation sugar mills, and even now such installations are uncommon and depend on the local generation of power. Perhaps indeed this field may continue to be occupied by isolated plants by reason of the plentiful fuel at hand. It is historically worth noting that the very first genuine commercial application of the electric motor was for operating a hoist for unloading beets in a French beet-sugar factory, now forty years ago.

From the brief paper by Clarence G. Hadley which appeared in our columns last week it appears that electric drive is being standardized in various Cuban sugar mills with very excellent results. The machines operated are crushing mills, pumps and centrifugals. Of these only the first named require special equipment. It is no easy task to crush the sugar cane swiftly and thoroughly so as to squeeze out the now doubly precious juice, leaving only the nearly dry bagasse behind. The great heavily pressed rollers are worked in tandem, the masses of cane passing between them in turn, and it is found necessary to work at variable speed to keep all the sets uniformly at maximum working load. Hence for this part of the drive slip-ring induction motors are used, with resistors for varying the speed at the will of the operator. In the typical mill equipment described by Mr. Hadley each tandem of five sets of rollers requires three 250-hp. motors, while the total demanded by the two tandems and the accompanying conveyors, pumps and centrifugals rises to more than 3000 hp. in nearly 100 motors. All are three-phase, 60-cycle, at 480 volts, and the power supply is from a central steam plant with turbo-generators. Bagasse, with a modest supply of wood to help in driving out residual moisture, is used for fuel, burned in Dutch ovens under simple return tubular boilers. The exhaust steam from the turbines does the first heating of the cane juice and the evaporation of the syrup, live steam being used only for the last stages of the sugar-making process. The installations already made have proved so successful that they are likely rapidly to increase in numbers.

Setting the Time Right

IMAGINE a vast electrical power plant designed without skill or harmony, built up at haphazard and housed in antiquated and inflammable buildings. Something goes wrong, short circuit follows short circuit with lightning rapidity, flames break out, and when at last the course of destruction is halted many of the buildings are in ruins, much of the machinery is a tangled mass of metal, and the best and bravest of the operators lie dead at their posts of duty. Such a picture as this the civilized world calls to mind to-day, after more than four years in which its great creative machinery, instead of carrying light and power to the nations, has been involved in a frenzy of destruction. Around the wreckage stand the peoples, and amid the babel of contending voices the dominant note is inevitably that of restlessness and discontent.

This universal unrest—no new thing, of course, but accentuated tenfold by the war—is felt in every branch of life. Students debate whether or not to resume their interrupted courses, teachers turn to new subjects and new methods, editors wonder what they should advocate, clergymen how they should preach. Time-serving politicians are at a loss. Business men are perplexed. The great masses of the population, oppressed by high prices and in the first stage of reaction from long-continued excitement, are not easily persuaded, edified or led. Public dissatisfaction everywhere runs high. Even the theaters find that the old entertainments no longer attract, and the sporting page itself has partly lost its charm. The status quo ante has few friends, and there will be no tame acquiescence in a reversion to things as they were.

All this is no vindication of the pessimist. Human progress has been built on discontent, and widespread ambition rather than widespread apathy is the token of a nation's health. Let no one despair. The patriotic ardor that has flamed so high will subside, but it will not be quenched. Common sense will assert itself to the discomfiture of red revolutionists and red reactionaries alike, but to the salvation of the nations. And here America, the oldest of the great democracies, will set a steadying example to Europe.

In the evolution of the new order of things the engineering mind, which may be possessed by statesmen as well as by technicians, has a great part to play. The engineering mind does not pile heavy structures on frail foundations, does not cover up faulty work with showy ornamentation, does not leave uneradicated defects that will grow and eventually bring disaster, does not miscalculate stress or power, never forgets the safety factor or the escape valve. There are axioms in statesmanship as irrefutable as any in mathematics. May the world be guided by political engineers with the wisdom to grasp and the courage to apply them!

The thoroughness and promptness with which we apply ourselves to the problems of reconstruction will determine in a large measure our future greatness. Our earnestness and zeal brought us quick and effective results in war, and if we are to keep a true perspective throughout the long period of readjustment we shall have need of these selfsame virtues in the years immediately before us.

The Modern Outdoor Substation

Apparatus Has Been Developed Until It Is as Reliable as Indoor Equipment, but Station Design Has Not Improved So Much—Notes on Transformers, Oil Circuit Breakers, Lightning Arresters, Air-Break Switches and Bus Supports

BY M. M. SAMUELS

WHEN the outdoor substation first appeared as a new and distinct type of construction a great many objections were raised against it by engineers and operators. Some thought that outdoor apparatus would not work satisfactorily under conditions of cold weather and snow; others held that it was not advisable to expose apparatus to the sun, and again others objected for the reason that apparatus placed outdoors would not receive so much attention from operators as it does when housed. All these and other objections have now been practically overcome, and many of the objectors have been so convinced of the advantages of placing high-tension apparatus outdoors that they would now strongly object to housing it. Thus the outdoor station, although of very recent creation, has come to be generally accepted as a matter of course. Most high-tension apparatus, regardless of whether it is for indoor or outdoor service, is now being built to stand up under outdoor conditions. Outdoor transformers, outdoor oil circuit breakers, outdoor metering apparatus and outdoor lightning arresters are now standard with all manufacturers of high-tension equipment and are as reliable in operation as any indoor apparatus was, and perhaps even more so.

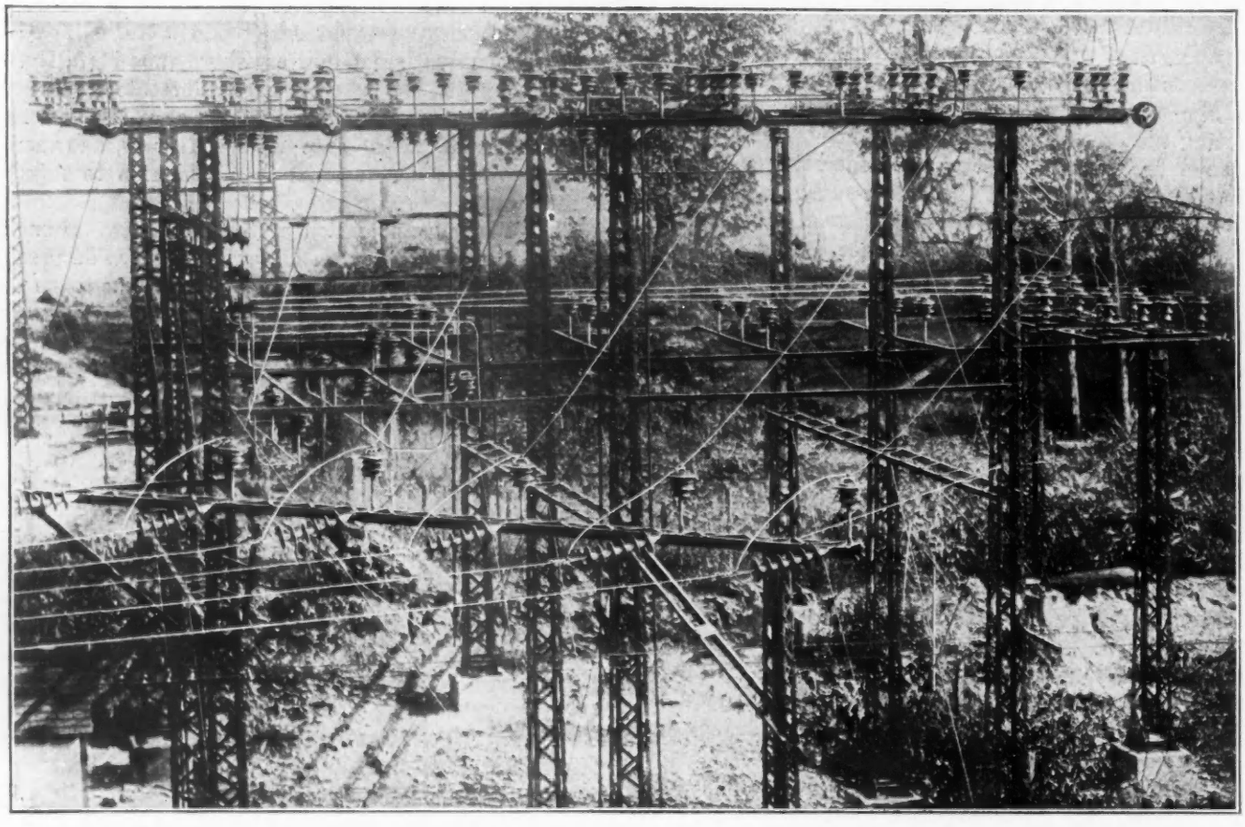
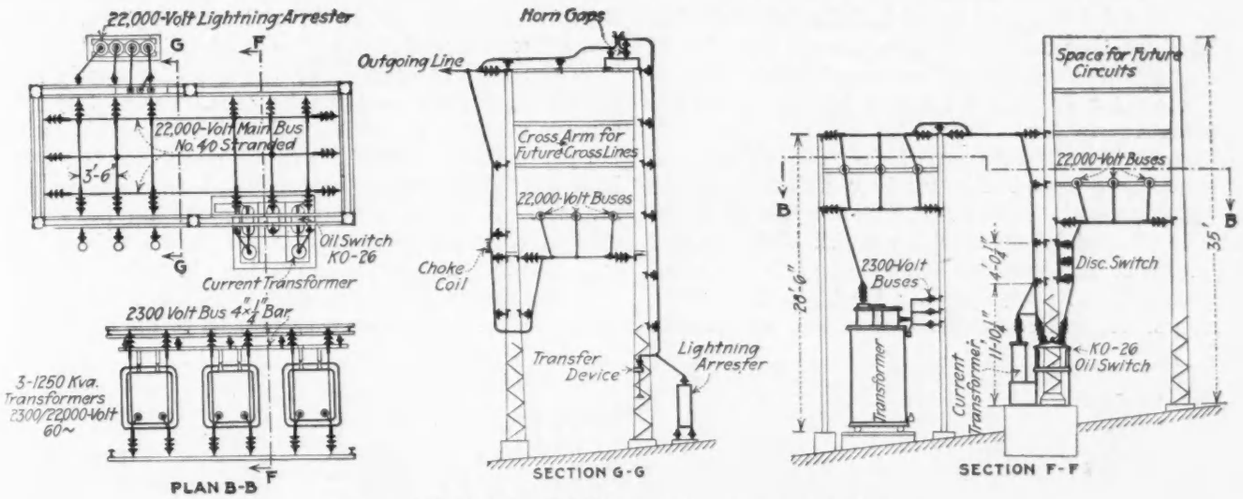


FIG. 1—75,000-VOLT SWITCHING STATION IN WHICH PRACTICALLY ALL SWITCHES ARE OF POLE-TOP TYPE. AIR-BREAK SWITCHES SPREAD OUT ON TOP TO AVOID TROUBLE FROM ARCS. (SEE FIGS. 10, 11 AND 12)

Transformers.—Many improvements in outdoor transformers have been made within the last year or two. Terminal troubles have practically been eliminated, all high-tension transformers now having their terminals on top of the case instead of on the side. Furthermore, no more difficulty is being experienced in laying out the proper connections to their terminals. The necessity of climbing ladders or mounting platforms for the purpose of reading transformer temperatures and the danger connected therewith have been done away with, since modern transformers are equipped with electrical temperature indicators, which can be mounted so that the reading can be done from the ground, or where a switchboard is available in a nearby building the temperature indicator can be placed on this switchboard. Some difficulty is still being experienced when it is necessary to read the oil gage, since no indirect method for this reading has yet been developed and the gage must be mounted at a considerable height near the top of the transformer tank.

Large transformers of the older type were water-cooled, requiring elaborate piping and pumping installations, cooling ponds or cooling towers. This was always a source of worry to operators as well as to station de-

signers, since outdoor piping and water pumping were very difficult to design properly, and since in the winter time great difficulty was usually experienced in maintaining the equipment in good operating condition. Modern transformers are therefore being designed for self-cooling. Most of the units are of the radiator type, tanks. The oxide-film arrester which was placed on the market recently promises to overcome many of the objections to the older types of arresters, but it has not been in operation long enough to make it possible to give accurate figures as to its operation, particularly for very high voltages and outdoor use.



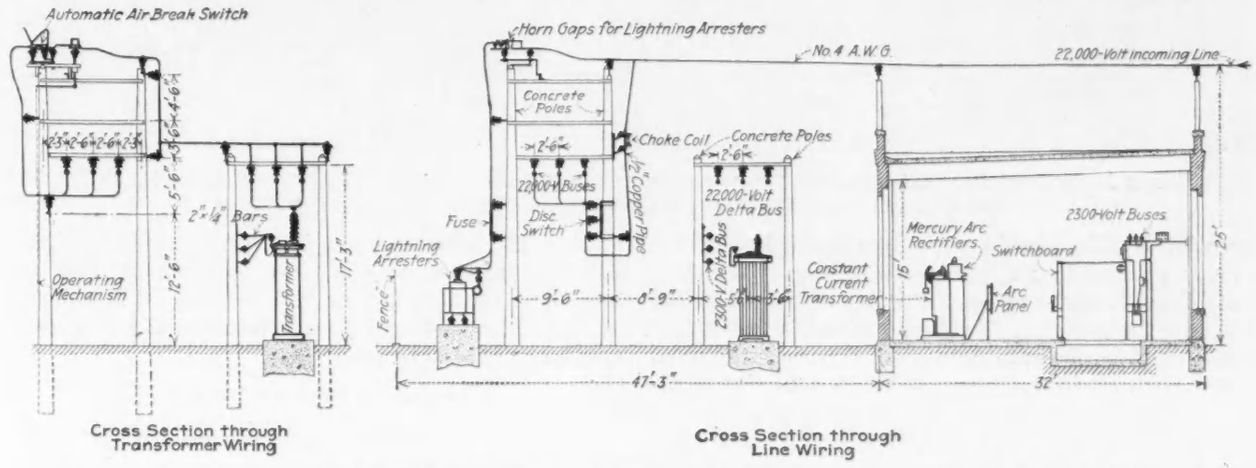
FIGS. 2, 3 AND 4—45,000-VOLT UNIT-TYPE SUBSTATION

this construction having given satisfaction even for large transformers of very high voltage.

The Oil Circuit Breaker.—Oil circuit breakers of high rupturing capacity and designed for voltages of 150,000 have withstood the severe operating conditions obtained out of doors and may be considered thoroughly reliable. However, with ever-increasing voltages the oil circuit breaker is increasing enormously in size, and it will probably reach its limit soon, when it will become necessary to develop entirely new methods of switching and of breaking the circuit. It is likely that when line voltages go up to 250,000 and higher the present type of oil circuit breaker will have to be of such large proportions and will require such enormous quantities of oil that its use will be impossible.

Lightning Arresters.—The lightning arrester has also been greatly improved within recent months. Many new devices have been introduced to prevent the burning out of charging resistances and the blowing up of

Choke Coils.—The improvements made recently on choke coils are practically all of a mechanical rather then electrical nature. Good choke coils have been developed which maintain their shape under operating conditions, and the flimsy coils of the past, in which the windings often came in contact with each other and even melted together, are gradually disappearing. However, there does not seem to be any agreement among manufacturers as yet on the proper dimensioning of choke coils, such as diameters, shapes of conductors, number of turns and amount of reactance. Since engineers asking bids on choke coils, as a rule, do not specify their requirements except as to current and voltage rating, competition tends to make manufacturers reduce the copper to a minimum, which, of course, does not result in reliable coils. This subject should be thoroughly considered by the standardization committees of the A. I. E. E., the N. E. L. A. and other societies interested, and an understanding should be reached as to what consti-



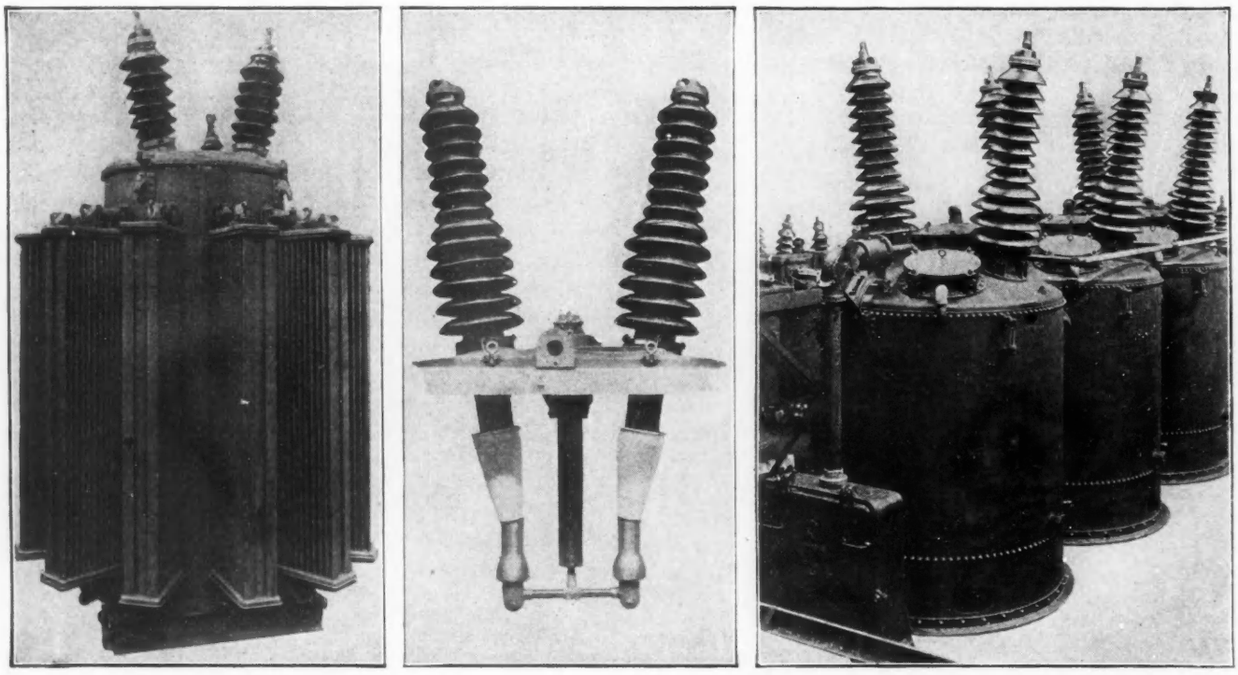
FIGS. 5 AND 6—45,000-VOLT SUBSTATION EMPLOYING PIN INSULATORS, THUS PERMITTING USE OF CONCRETE POLES

tutes a standard choke coil for a given voltage, a given current and a given frequency. At present no distinction is being made between choke coils of various frequencies.

Air-Break Switches.—A great many types of air-break switches, disconnecting switches, busbar supports, etc., have been developed for outdoor use and have been tried out and found satisfactory under all kinds of weather conditions, even though this line of apparatus still offers aud will continue to offer for some time to come a large field for new inventions and developments.

There are two distinct types of air-break switches and mechanically operated disconnecting switches on the market at present. In the first type the motion of the blade is affected by an insulator which pivots around its own axis. The insulator being exposed to torsion at every operation, its top, to which the blade is attached, or its pin very often breaks and causes considerable operating trouble. In the other type the motion of the blade is affected by an insulator which rocks around a shaft at right angles to the center line of the pin. With this type the porcelain is always exposed to a bending moment and breaks even more often than with the pivot type. Neither of these types, although both give excellent results in many cases, can be considered as final. New apparatus will have to be developed based upon sounder mechanical principles and operating experience. Ice and sleet trouble on air-break switches, although partly overcome, should still be the subject of thorough study by switch designers and inventors if a perfect air-break switch is to be developed. The hoods which are generally used as sleet protectors do not always serve their purpose; they very often act as accumulators of ice and snow rather than shields. New methods will have to be devised to protect the switch contacts.

Bus Supports.—Various types of bus supports are now obtainable, suitable for outdoor substations and arranged to accommodate copper pipe of various sizes, both for horizontal conductors and for vertical conductors. While the post-type or pillar-type supports are both too heavy and too expensive for the purpose, petticoat insulators with suitable cap and pin design are satisfactory for solid (non-flexible) buses in outdoor stations. For vertical conductors it is advisable to mount the insulator at 45 deg. to the horizontal to prevent rain water from accumulating on the inside of the petticoats. This can be accomplished by the use of properly designed angular pins and angular caps. The part of the support which is to be attached to the steelwork, be it the pin or the cap, should have not more than two bolt holes, so that it can be accommodated on a single steel member. If three or four more mounting bolts are used, it is necessary to provide two steel members for each support. Either the cap or the pin or both should be adjustable so that the support can be mounted either on a steel member which runs parallel to the conductor or at right angles to same. It is very essential to have this adjustment since it is generally necessary to order bus support before the station steel design is finished and is not possible to tell in advance exactly how each member will be arranged.



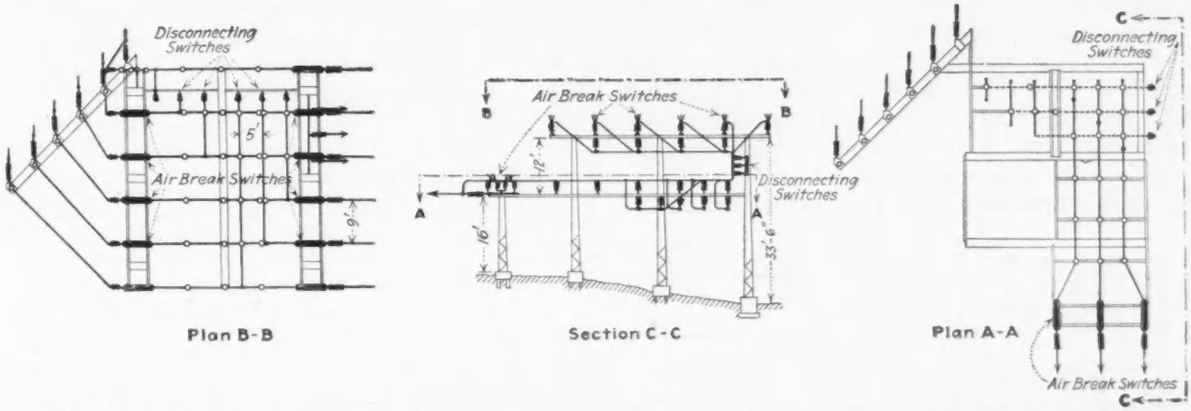
FIGS. 7, 8 AND 9—SELF-COOLING 2500-KVA., 66,000-VOLT OUTDOOR TRANSFORMER; TERMINALS AND SWITCH CONTACTS OF 140,000-VOLT, 400-AMP. OIL CIRCUIT BREAKER; 135,000-VOLT, 400-AMP. OUTDOOR OIL SWITCHES

Status of Station Design

In spite of the wonderful improvements made within the last year or two on outdoor apparatus, most of the designs of the outdoor stations themselves are still open to a great deal of criticism. Most designers of outdoor stations still persist in using the old primitive method of setting four heavy steel towers, one in each corner of the station, and of connecting these towers in both directions by heavy steel trusses and span wires. Many times when it is necessary to make a connection between pieces of apparatus a span extending from one support to another is installed even when the apparatus to be joined is close together. This, of course, requires

very heavy steel work and an endless amount of floor space. In addition to this, strain disconnecting switches or other types of hook-operated disconnecting switches are installed at great heights, and it is necessary to build high platforms to make it possible to operate these switches even when using the clumsy switch hook of 12-ft. or 15-ft. (3.7-m. to 4.6.-m.) length. Under pressulator may cause a wire to drop across the buses, short-circuiting them and thus putting the whole station out of service. This is not likely to happen to a solid bus.

In order to reduce the number of insulators in the solid bus station to a minimum, tubing should be used for conductors in preference to wire or bar. Insulators spaced about 10 ft. (3 m.) apart on ½-in. (13-mm.)



FIGS. 10, 11 AND 12—75,000-VOLT SWITCHING STATION SHOWN IN FIG. 1, USING PIN INSULATORS AND SOLID BUSES EXCLUSIVELY

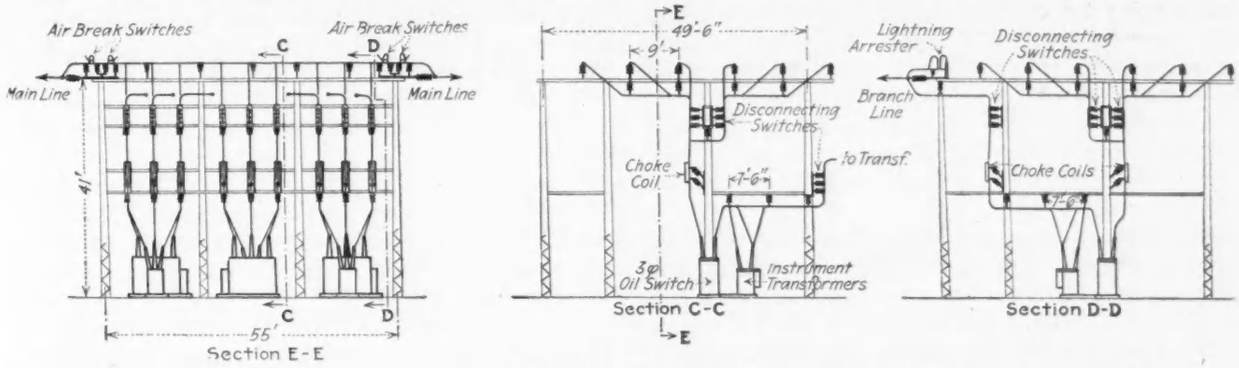
ent conditions, when every economy is of extreme value and when the waste of steel must be considered a crime, more consideration should be given this subject by designers of outdoor substations.

It is obvious that when strain insulators are used and a strain span is installed for every bus, connection or tap the steel work will have to be very heavy (strong enough to take care of all the pulls to which it is subjected), whereas if a solid bus is used the steel work may be comparatively light, since it has only to carry the weight of buses, connections and insulators. The tendency in outdoor substation design must therefore be to eliminate strain spans and substitute solid bus work.

It must, of course, be admitted that, whereas it is a comparatively easy matter to design a station of the strain-span type, the design of a solid bus station requires a great deal of skill and designing ability. But pipe bus will generally give a good appearance, whereas when a wire or a bar is used as a conductor supports will generally have to be installed ever 4 ft. or 5 ft. (1.2 m. to 1.5 m.).

In addition to the above-named advantages of the solid bus station the possibility of extension must be considered. A strain-type station is generally dead-ended, and a great deal of difficulty is experienced when it becomes necessary to add feeders or transformer circuits, whereas the solid-bus station can be designed as a unit type, so that any number of circuits can be added at any time and it is not necessary to make the initial installation of steel work and concrete heavy enough to take care of future requirements.

The general requirements to be met in the design of outdoor substations are: (1) simplicity, (2) safety, (3) a minimum of steel, (4) a minimum of space, (5) flexibility and interchangeability of circuits, and (6) pos-



FIGS. 13, 14 AND 15—OUTDOOR STATION EQUIPPED WITH OIL CIRCUIT BREAKERS AND METERING EQUIPMENT (SEE FIG. 19)

when the results are considered it is well worth while to apply the best designing skill to developing outdoor stations which will occupy the minimum of space and will require the minimum of steel.

In addition to the economy in steel, the solid-bus type of station has a great many more advantages as regards safety and continuity of operation. For instance, in the strain-span station any injury to even one disk insibility of extension without disturbing old circuits. All connections should be made by clamp fittings, so that apparatus can be disconnected, removed or replaced without keeping the circuit or the bus out of service for an excessive period of time. Soldered or welded joints should therefore be avoided as much as possible. When running a pipe connection from a transformer or a switch to a bus care should be taken to allow for ex-

pansion and contraction, otherwise the bus may be pulled off its supports or the insulators broken. One right-angle turn in each connection will generally be sufficient for the purpose, and it is never necessary to provide unsightly loops.

The 45,000-volt station shown in Figs. 2, 3 and 4 inclusive is a good illustration of the unit-type idea. This station shows that with skillful designing the unit idea can be applied even when strain insulators are used. Strain insulators had to be used in this case because they were readily available, whereas solid bus supports could not be obtained within the time allowed. It will be noted that with this type of design the lines can run into the station from any direction.

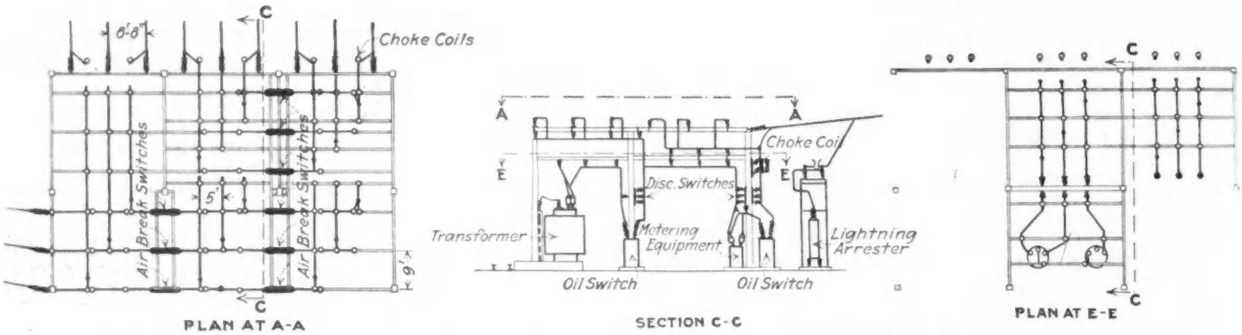
The lightning-arrester horn gaps are placed at the very top of the structure, and the lines go directly to the gaps and thence to the electrolytic tanks without any loops or semi-loops in the discharge circuit. This arrangement should be adhered to wherever possible, since a direct path from the line to the arrester is always the best.

Provision is made on the low-tension side of the transformers for phasing out. Three bars are installed the full length of the three transformers which make up a bank, and connection bars are provided from each transformer to these buses, so that whenever it is necessary to interchange a phase it can be done by simply interchanging the connection bars, which are attached to the buses by means of clamps. This arrangement is preferable to the phasing out of the high-tension side of the transformers. The low-tension circuits connect with underground cables through a set of potheads mounted on one of the steel columns. Bar connections are provided between the potheads and the low-tension transformer delta buses.

Figs. 5 and 6 show a 45,000-volt station which is similar in type to the one above, with the exception that it is a solid-bus station. The use of a solid bus made it possible to use concrete poles instead of steel, thus not only reducing the cost but making it possible to complete the work in a much shorter time than would be possible with steel poles on account of the long delivery on steel. If strain buses were used, concrete poles would, of course, be out of the question. There are other interesting features in this station. It is a combination indoor and outdoor station. The 2300-volt switching and the constant-current transformers for lighting as well as the instrument switchboard are housed, whereas the transformers and the high-tension switches are outdoors. The line is equipped with an automatic air-break switch which was considered sufficient for the present load. However, as may be seen in the cross-section, provision has been made for the installation of oil circuit breakers to replace the automatic air-break switches as the load on the line increases.

Two sizes of concrete poles are used in this structure. The larger ones, used to support the line equipment, are 33 ft. (10 m.) long and have 18-in. (45-cm.) square butts and 8-in. (20-cm.) square tops. The smaller poles used for the transformer wiring are 23 ft. (7 m.) long and have 15-in. (38-cm.) butts and 8-in. (20-cm.) tops.

The 33-ft. poles have ¾-in. (19-mm.) reinforcing bars in each corner extending the entire length of the pole.



FIGS. 16, 17 AND 18—70,000-VOLT OUTDOOR TRANSFORMING AND SWITCHING STATION (SEE FIG. 20)

Besides these there are two rods symmetrically placed in each of two opposite faces. These additional rods extend from the base 17 ft. (5 m.) up the pole. The rods are tied together about every 2 ft. (60 cm.). To permit attaching the steel cross members used in the station 1¼-in. (32-mm.) standard steel pipe is cast in the poles through which to run the clamping bolts. The 23-ft. poles are similarly reinforced in the corners but lack the additional reinforcing.

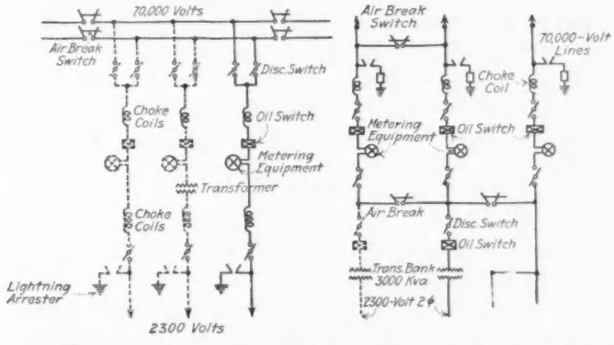
The argument is often heard that whereas in stations of comparatively low voltages a solid bus may be satisfactory, this construction is not advisable with stations which must operate at very high voltage, because a greater distance must be maintained between conductors and because of the extensive use of pole-top switches. This is not at all true, since solid-bus stations have been designed, built and maintained for 75,000 volts and even higher.

Figs. 1, 10, 11 and 12 show a 75,000-volt switching station in which practically all the switches are of the pole-top type. As a result the wiring seems rather complicated on first sight. In spite of this the construction is very simple and the steel work is very light. None of the steel poles is over 1.5 ft. (45 cm.) wide at the base, and all the cross-pieces consist of single steel members. No trusses or plate girders are required. All conductors, switches and insulators are easily accessible for repairs, and it is not necessary to deënergize the whole station for the purpose of working on one circuit. All disconnecting switches are operated by mechanisms from the ground, and no operating platforms are required.

The station is merely a switching station for the purpose of selecting a branch line from a double-circuit 75,000-volt transmission line. Air-break switches are

provided in each main line at each side of the connection to the branch line. These had to be spread out on top of the structure in order to avoid trouble from the arcs and to provide the necessary clearance between phases. The branch circuit, however, required only a double-through disconnecting switch so the necessary switching equipment is arranged in vertical planes, thus reducing the space and the lengths of the steel members to a minimum.

Figs, 13, 14, 15 and 19 show a station similar in character to the one described except that an oil circuit breaker has been added in the branch line together with metering equipment. High-tension metering equipments are now standard apparatus and operate satisfactorily. They generally consist of an oil tank in which are contained two current transformers and two potential transformers, requiring a total of only three high-tension terminals, whereas if each current and potential transformer had its individual tank a total of six high-tension terminals would be required. The meter itself is generally placed in a steel compartment on the side of the metering equipment. If a building is nearby, the meters may be installed inside by simply



FIGS. 19 AND 20—SCHEMATIC DIAGRAM OF CONNECTIONS FOR STATIONS SHOWN IN FIGS. 13 AND 16

running the secondary instrument leads from the instrument transformers to the metering equipment in an underground conduit or overhead on a messenger suspension.

Figs. 16, 17, 18 and 20 show that the ideas developed above can be applied also to more elaborate stations. This station contains not merely switching and metering devices but also self-cooled transformers of considerable size and for 70,000-volt operation. The station is built on a hillside in a limited space. It is obvious that it would be impossible to accommodate all the apparatus and wiring in the given space if strain disconnecting switches were used, or if it were necessary to provide strain spans for every connection. Only through the use of solid buses and mechanically operated disconnecting switches in vertical planes was it possible to design a station for this restricted space.

Outdoor substations should be well lighted for the purpose of inspection and repair by night. Floodlighting, which was first suggested by the author in these columns for outdoor stations, has been found to be not only preferable to other forms of illumination but the only satisfactory method, and it is now in common use.

All of the stations described above, which may be considered models of modern outdoor stations were designed and installed by the J. G. White Engineering Corporation of New York.

SPEEDING UP MANUFACTURING BY IMPROVING ILLUMINATION

Actual Plant Tests Indicate 15 per Cent Increase in Production at Cost of 5 per Cent of Payroll—Equipment Found Relatively Inexpensive

RESULTS of tests being conducted by engineers of the Commonwealth Edison Company to determine quantitatively the effect upon industrial output of increased and improved illumination were outlined in a paper entitled "Production Lighting Intensities," read before the recent convention of the Illuminating Engineering Society by William A. Dur-

FIG. 1—TYPES OF LIGHTING EQUIPMENT FOUND IN MANY FACTORIES

gin. The ninety-three plants thus far surveyed total 17,400 employees, cover a floor area of 96 acres and aggregate a lighting load of 1420 kw. While the survey is largely inspectional, listing the number, style and condition of units used, and applying arbitrary utilization factors to obtain the intensities produced, very considerable confidence is felt in the average results, which show a mean of 1½ ft.-candles now in use with variations from 0.01 ft.-candle to 10 ft.-candles and an average consumption of 0.33 watt per square foot and 80 watts per employee. For these same plants the I. E. S. code would provide an average intensity of 5.5 ft.-candles, 3.66 times the present level. The intensity would vary from 2 to 12 foot-candles; the average watts per square foot would be 1, and the watts per employee 240, or three times the present consumption. The average of 1½ ft.-candles is produced by such units as in Fig. 1.

In order best to explain the method of making tests and to indicate results thus far obtained the original paper is quoted as follows:

"Such tests are much more difficult than at first thought appears. Our revised program contemplates

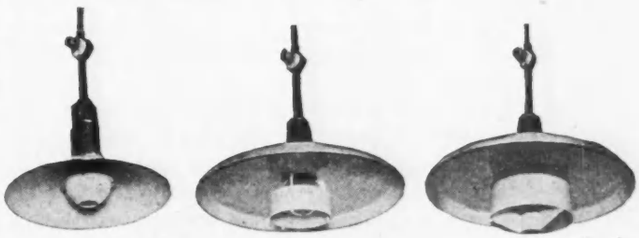


FIG. 2—TYPES OF GLARELESS FIXTURES RECOMMENDED IN SEVERAL PLANTS

a four months' run—the first month with the equipment as it exists, the second with proper equipment to give 50 per cent higher intensity than the maximum recommended by our code, the third month at the lower code level for ordinary practice or what is generally considered good present practice, and the fourth again at the higher or productive intensity level. For such a test the plant production records must be accurately

kept and a fair percentage of the work must be done in hours of darkness. The chief difficulties are two—(1) to find plants with adequate production record systems, and (2) to induce the plant to return to the lower level of intensity at the end of the second month of the run after the advantage of good lighting has been once experienced.

"Thus far we have sold the productive intensity idea and necessary equipment to eleven plants. From two of these we have secured reliable data. The first has already been noted briefly in Mr. Millar's paper on 'Lighting Curtailment.' The test was run in a machine shop producing soft metal bearings, operations ranging from rough to fine. Only two months of the program were run, but in the month at which the intensity was maintained at 12 ft.-candles production in the several operations was increased from 8 to 27 per cent over that of the previous month, when an intensity of 4 ft.-candles was used. In this instance general lighting with deep-bowl reflector equipment was employed for both intensities and every precaution taken to eliminate commercial bias. The superintendent was so impressed with the value of the higher intensity that he had it extended to the other floors of the building. In the second accurate test the program could not be followed carefully, the comparison being between bare lamps on drop cords and a properly designed reflectocap installation. The new equipment gave about twenty-five times the intensity previously used and showed an increased production of from 30 to 100 per cent in the several operations of a large pulley machine shop. Again the superintendent was enthusiastic. In the other nine plants it has been impracticable to run tests, but in every case the superintendents and owners are fully convinced of the truth of our statement that the average effect will prove at least a 15 per cent increase in production at an increased cost of not more than 5 per cent of the payroll.

"To get results quickly it is impracticable to secure the absolute best equipment for each installation. In our own company, therefore, we have adopted definite specifications employing three general types of equipment:

"1. Gas-filled lamps with steel reflectors and eye shields in the 200, 300 and 500-watt sizes.

"2. Gas-filled lamps with deep-bowl reflectors for extreme mounting heights.

"3. Vacuum lamps and deep-bowl reflectors for certain drop-cord applications.

"Our effort is concentrated upon the first class, examples of which are shown in Fig. 2. In using these eye-shield units it is of first importance that the shields be sealed in place and only removable by the foreman or other authorized employee, for the ordinary workman believes but one part of the code. He wants more light, but he knows nothing of the effect of excessive brightness contrasts and if left to himself will remove the shield as a useless obstruction. Recent installations of all three units are equipped with such sealing wires.

"Of the three we are especially emphasizing the 300-watt unit. It has an efficiency of some 84 per cent, a maximum brightness of 7500 millilamberts on the interior of the diffuser ring, and is well adapted to installation on present outlets. In many plants it is hardly possible to rewire now; in others it is very questionable whether such rewiring is warranted. But with this unit giving its maximum candlepower at the 50 deg. angle it is entirely practicable to produce reasonably uniform lighting with spacings of 14 ft. to 16 ft. (4.2 m. to 4.8 m.) at mounting heights from 10 ft. to 16 ft. (3 m. to 4.8 m.).

"Where 12 ft. to 18 ft. (3.6 m. to 5.4 m.) mounting heights above the floor are possible, spacings as high as 20 ft. (6 m.) can be used with the 500-watt unit, with an acceptable result in uniformity of intensity and diffusion of light. This unit has an efficiency of 77 per cent and a maximum brightness of 2300 millilamberts, the view of the interior of the ring being largely cut off by the blades. Again it may be emphasized that our object is not ideal illuminating engineering; it is practical application with as little change in wiring as possible. In these installations we are to secure productive intensity quickly at minimum expense with equipment which will continue to supply that intensity during its life.

"Of primary importance, therefore, is the ease with which such equipment can be maintained. With the drop-cord units of Fig. 1, bare or shaded by the tin dirt collector, even the extremely serious defects in intensity produced and brightness contrasts permitted are hardly as important as the extreme inefficiency which results after the machine has spattered them with oil or the workman has manipulated them with dirty hands. We have tested several such units taken directly from factories and have found the utilization efficiency less than 25 per cent."

PLANNING THE EDUCATION OF THE POWER-PLANT MEN

Illinois Fuel Administrator Expects to Send Weekly Letter to All Plant Operators and Owners to Impress Methods of Conservation

To keep before power-plant owners and operators the various economies that will effect the saving in coal requested by the Fuel Administration and to maintain interest in conservation at the proper pitch, Joseph Harrington, administrative engineer for Illinois, has adopted a plan of sending weekly letters to all plants in the state. In each letter one specific subject will be treated. It is the intention that the entire week be given by each owner to a careful examination of his plant with reference to the subject of the letter. If improvements are possible, immediate steps are to be taken to better conditions. During the following week there will be another letter on a different subject and so on until all factors influencing economy in the boiler room have been covered.

The series started with a general letter and a questionnaire on coal storage. "Directions for Operating Hand-Fired Boilers" was the subject for another week. Boiler covering, flue-gas analysis, coal weighing, soot, water purification, boiler-room records, etc., are also to be covered.

A copy of the letter on firing methods includes paragraphs on blowing flues and similar work, number of boilers to be kept in service, method of firing, draft control, when furnace should be fired, control of steam pressure and night service.

Attitude of Central Stations on Rates

Questions Which Are Involved in War and Peace Adjustments of Rates to Meet Changed Economic Conditions—Duration of the Period of High Costs

In these statements, as in the similar expressions of views in the articles printed on Sept. 7 and Nov. 2, widely different opinions on rate questions are given. The rate situation is involved with other large economic questions affecting the country, and its treatment is tempered in individual localities by the degree in which the communities are influenced by the general problems.

CONSIDERATION of rate-making problems is still continuing because no change has developed in the underlying factors of cost. The statements quoted below include the viewpoint of one company which, while it did not find increases necessary, adopted the policy of suspending periodical decreases.

"CONTINUE TO ASK FOR JUST INCREASES"

B. C. Cobb of Hodenpyl, Hardy & Company, Inc., New York, and president of the Consumers' Power Company and other operating properties of the Commonwealth Power, Railway & Light Company, says to the ELECTRICAL WORLD:

"All of the properties in which we are interested—*i.e.*, the subsidiary properties of the Commonwealth Power Railway & Light Company, located in Michigan, Ohio, Indiana and Illinois—have been endeavoring to get increases in rates charged for services, not only rates for electric service, but rates for gas and railway service as well, and they are in a certain measure meeting with success.

"We have found the attitude of the commissions, public authorities and the people not just the same in all of the communities and states. However, I am inclined to believe that there is a growing sentiment in favor of granting the utility properties a higher rate of charge; in other words, I think there is a realization of the fact that unless they are allowed to increase the charging rate they will be unable to subsist.

"Generally speaking, the rates secured so far have failed to offset entirely the higher operating costs. However, they have been helpful and I am sure will be followed by other increases."

Writing under a later date in further reply to an inquiry from the ELECTRICAL WORLD, Mr. Cobb amplifies his statement as follows:

"We are still meeting with success in obtaining increases in rates for service. Not always do we get what we believe we are justly entitled to. The sentiment, however, as I stated to you in my former letter, in favor of granting the utility properties higher rates of charge, I still think, is growing.

"I think it is generally conceded that the class of service using the greater portion of the output—*i.e.*, power business—should bear the largest proportion of the increase in rates, and I think it is in this class of service that most of the increases have been secured. This is quite logical, for it was this class of service which was first and most affected by the increased costs of coal, labor and material. Private plants have felt these increased costs the same as the central stations—even more so—and the tendency has been to some considerable extent, I think, to shift the load from these private plants to the central stations.

"I don't intend by the foregoing to say that the lighting rates should not be increased, for this is directly contrary to my thoughts. We are gradually, wherever there may be cause, increasing our lighting rates, feeling that the time has come when the lighting consumer should begin to bear a portion of the increased costs.

"I am not of the opinion, now that the war is over, that we are going to see any sudden decrease in cost of production, and I firmly believe that it behooves the central-station operator to continue manfully to ask for increases wherever and whenever it can be justly shown they are needed."

A VIEWPOINT NOT BASED ON INCREASED RATES

An important central station in the Middle West which has not raised its electric service rates has the following comment on the rate situation in general:

"Our rates were thought to be both war-proof and peace-proof. Since the war started we have not found it necessary to increase rates, and we do not anticipate that it will be necessary in the future. We believe prices of commodities that go to make electric service have about reached their peak as far as we are concerned.

"Two factors have been important among those which made it possible for us to keep from increasing rates. They were (1) our ability to reduce the cost of operation by retrenchment, by changing lamp policies, by elimination of gratuitous services and by other means, as the cost of operation rose, and (2) the increase in net earnings made possible through discontinuing a well-established policy of periodically reducing rates.

"In spite of the fact that the rates have not been raised, neither the security holders nor the reserves have suffered. It is foreseen that after the war there will be some who will say that the company must have been making more than a fair return in peace times, else it could not have gone through the war without relief in the form of higher rates. In answer to this the company can point to the actual increase in net earnings which has been the result of its new policy of adhering to present rates instead of reducing them periodically as it previously had done."

This same company during this period of rate disturbances has studied some of the factors in residential rates. The rates in general are of the demand and energy type. In its rate structure the lighting consumer with less than 1½ kw. connected is billed on an estimated demand which is a fixed percentage of the connected load taken in conjunction with a certain number of hours' use of that demand. The estimated demand is based on lighting load only. Studies have shown that peak demands in residential districts are no longer created by lighting. Appliances are the rul-

ing factor. While no change in the rates taking this into effect is contemplated, the situation is fully realized. The company feels that it is virtually giving these small consumers a lower rate by delaying the recognition of these facts.

SMALL ADVANCES MADE IN AMERICAN LIGHT & TRACTION PROPERTIES

Alanson P. Lathrop, president American Light & Traction Company, says to the ELECTRICAL WORLD:

"We have received a small advance in our electric rates in one company and are endeavoring to get a still further advance in the same company, but with what degree of success remains to be seen.

"Another of our companies received an advance of 1 cent per kilowatt on all classes of business, effective on Nov. 1."

NO RAPID DECREASES IN RATES

C. A. Paul, manager of the United Illuminating Company, Bridgeport, Conn., does not anticipate any rapid decrease in electric utility rates in the after-the-war period. Public service companies did not increase their rates until long after general commodity and labor costs rose far above normal, and a gradual subsidence in prices rather than any sudden drop is to be expected after hostilities are concluded. Mr. Paul believes that the cost of coal will be high for a long time in comparison with pre-war prices, and this, with the high wages labor is likely to demand, will make reductions in rates difficult. Ultimately it would seem that wages must be lowered somewhat to compensate for the recession expected, in the general price list, but it is apprehended that this will be accomplished only in the face of great opposition on the part of labor.

Calibration of Power-Factor Indicators

Method of Calibrating Polyphase Power-Factor Indicators of Which the Resistances of the Potential Circuits Are Not Equal—Also Applies to Indicators in Which Current Coil Is in One Phase of a Two-Phase Line

BY WALTER WESTCOTT HOKE

In the Feb. 2, 1918, issue of the ELECTRICAL WORLD there was published an article by Thomas W. Varley dealing with the direct-current calibration of power-factor indicators. Mr. Varley brought out the advantages to be gained by such a method, and, as a result, the writer, in collaboration with H. Heitman, undertook to calibrate the Philadelphia Electric Company's polyphase power-factor indicators of the electrodynamometer type by means of the above method.

THE principle of operation and the details of construction are not always exactly the same for different makes of instruments, and hence this article is supplementary to that by Mr. Varley in that it describes a way to calibrate polyphase power-factor indicators of which the resistances of the potential circuits are not equal, and indicators of which the current coil is connected in one phase of a two-phase line.

Consider the vector relation between the current in the current coil and the currents in the potential coils for a three-phase indicator. For unity power factor (Fig. 1) the current I_{p_1} in one potential coil leads the current I_c in the current coil by 30 deg., while the current I_{p_2} in the second potential coil leads by 150 deg. Now for a lagging power factor (cos Θ) the torque acting on potential coil 1 is proportional to the flux threading it, owing to the current, I'_c times the component of the vector I_{p_1} along the vector I'_c. Hence:

$$T_1 \propto \Phi_{c_1} I_{p_1} \cos (\Theta + 30).$$

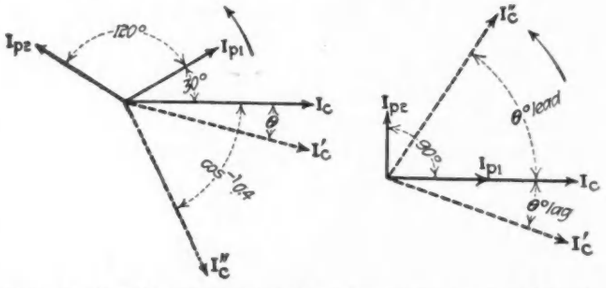
In a like manner:

$$T_2 \propto \Phi_{c_2} I_{p_2} \cos (\Theta - 30).$$

As a means of calibration it can be readily seen that if currents proportional to $I_{p_1} \cos (\Theta + 30)$ and $I_{p_2} \cos (\Theta - 30)$ are passed through the potential coils, the same deflection corresponding to the lagging power factor cos Θ will be obtained. Evidently alternating as well as direct current can be used provided that the currents in the potential circuits are in phase and the current coil circuit is connected to the same source. Such currents in the potential circuits must then be in the following ratio:

$$\frac{i_1}{i_2} = \frac{\cos (\theta + 30)}{\cos (\theta - 30)} \times \frac{R_2}{R_1},$$

where R_1 and R_2 are the normal resistances of potential circuits 1 and 2 respectively. This can be accomplished by placing a resistance R_x in series with potential cir-



FIGS. 1 AND 2—VECTOR RELATIONS BETWEEN CURRENTS IN POTENTIAL AND CURRENT COILS FOR THREE-PHASE AND TWO-PHASE INDICATORS

cuit 1. Since both circuits are connected in parallel across the same voltage (Fig. 3),

$$(R_1 + R_x) i_1 = R_2 i_2,$$

or

$$R_x = R_1 \left[\frac{\cos (\theta - 30)}{\cos (\theta + 30)} - 1\right].$$

For a leading power factor, the current i_1 becomes greater than i_2 and the additional resistance is placed in series with R_x. In that case:

$$R_x = R_2 \left[\frac{\cos (\theta - 30)}{\cos (\theta + 30)} - 1\right].$$

For leading or lagging power factors equal and less than 40 per cent, the components of I_{p_1} and I_{p_2} along I_c become in phase. In order to secure the proper amount

and direction of current in the potential coils, the latter are placed in series and a shunt connected across either R_1 or R_2 (Fig. 4), if the power factor is lagging or leading respectively. This shunt will have the following value, for a lagging power factor:

$$R_x = R_1\, i_1/(i_2 - i_1)$$

or

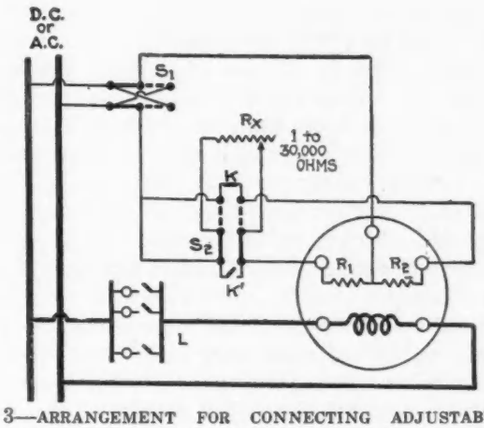


FIG. 3—ARRANGEMENT FOR CONNECTING ADJUSTABLE RESISTANCE IN SERIES WITH POTENTIAL CIRCUIT

$$R_x = \frac{R_2}{[\cos(\theta-30)/\cos(\theta+30)] - (R_2/R_1)},$$

and for a leading power factor:

$$R_x = R_2\, i_2/(i_1 - i_2)$$

or

$$R_x = \frac{R_1}{[\cos(\theta-30)/\cos(\theta+30)] - (R_1/R_2)}.$$

For a two-phase indicator (Fig. 2) the current I_{p_1} in one potential coil is in phase with the current I_c in the current coil, while the current in the second potential coil leads I_c by 90 deg. Hence the currents to be passed through the potential coils will have to be in the following ratio:

$$i_1/i_2 = (\cos\Theta/\sin\Theta) \times R_2/R_1.$$

When the vector I_c lags the components of I_{p_1} and I_{p_2} along it are in opposite directions. Hence for power factors equal or greater than 80 per cent a resistance of $R_2[(\cos\Theta/\sin\Theta) - 1]$ is placed in series with R_2, while for power factors less than 80 per cent a resistance of $R_1[(\sin\Theta/\sin\Theta) - 1]$ is placed in series with R_1. Considering a leading power factor, the components of I_{p_1} and I_{p_2} along I_c'' are in the same direction. Since the current in one of the potential coils must be reversed and if the inside leads from these coils are not accessible, shunts again have to be connected across either of the potential coils placed in series. But in this case R_2 is larger than R_1 and these resistances change with different makes of instruments. On that account the leading power factor at which the current i_2 becomes greater than i_1 will vary. But it will be found that for power factors greater than 50 per cent a shunt of $R_1/[(\cos\Theta/\sin\Theta) - (R_1/R_2)]$ is placed across R_2, while for power factors less than 50 per cent a shunt of $R_2/[(\sin\Theta/\cos\Theta) - (R_2/R_1)]$ is placed across R_1. However, for two-phase indicators of the General Electric type, unlike the Weston type where the potential coils are joined inside the instrument (Figs. 3 and 4), the four potential-coil terminals are connected to four outside posts. In that particular case it is more convenient to add resistances to either potentia. circuit according to the power factor in exactly the same manner as for lagging power factors, but to reverse the current in one of the potential coils. This method does not hold for three-phase indicators of the same make.

The wiring used for this method of calibration is shown in Figs. 3 and 4. Reversing switch S_1 is convenient for giving the proper direction of current through the potential coils, for if the latter currents are not in the proper direction with respect to the current in the current coil the needle will tend to indicate 180 mechanical degrees away from the required power factor. However, some instruments are provided with such scales as to take advantage of a reversal of power. The double-throw switch S_2 in Fig. 3 is used in conjunction with keys K and K' to place the additional resistance R_x in series with either potential circuit, while in Fig. 4 S_2 is used to place the resistance in parallel with either circuit. The lamp bank L governs the normal current through the current coil. R_x consists of two resistance boxes, one ranging from 1 ohm to 10,000 ohms and the other from 10,000 ohms to 100,000 ohms in steps of 10,000.

Figs. 3 and 4 apply to both Weston and General Electric instruments, with the distinction that for the latter the resistances in series with the potential coils and forming part of the potential circuits R_1 and R_2, as shown in the figures for the Weston type, are not within the instruments but have to be connected externally to the potential-coil posts. Another distinction arises from the fact that for two-phase indicators of the General Electric make the potential coils have to be connected together externally. Evidently the wiring shown in Fig. 3 suffices for the calibration of the latter instruments.

As to the procedure to follow, the normal resistance of the potential circuits of all the instruments to be calibrated are first determined. In this connection a small

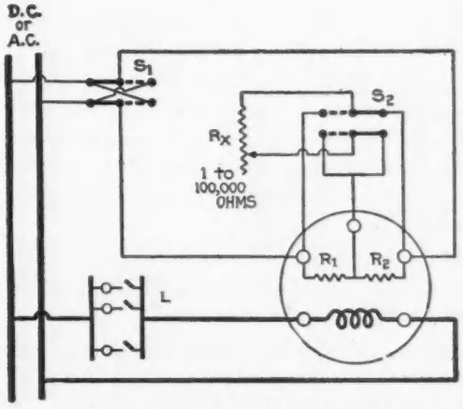


FIG. 4—METHOD OF SHUNTING RESISTANCE ACROSS POTENTIAL COILS

portable Wheatstone bridge can be used. Three-phase indicators are calibrated from unity to 40 per cent power factor leading or lagging. Then lagging power factors for two-phase indicators are calibrated. Should the latter be of the General Electric class, leading power factors are calibrated at the same time. Next the wiring is changed to that shown in Fig. 4. Leading power factors and finally the remaining points for the three-phase instruments are calibrated. If some of the

instruments have the normal resistances of their potential circuits very nearly equal, the resistances calculated for one may be used for all of those instruments.

The accompanying table proves convenient for the computation of the resistances, and in this connection slide-rule work is sufficient, since a deviation of 1 per cent from the actual value of the computed resistance has no effect on the reading taken on the scale, even for power factors close to unity where the divisions of the scale are greatest. Should the resistances R_1 and R_2 be nearly equal, as is often the case for three-phase indicators of the Weston class, their ratio may be taken as unity, this materially reducing the computation of the shunts to be placed across either R_1 or R_2, and the error involved will not be appreciable. This never applies, however, to two-phase indicators having their current coils connected in one of the phases, for in that case R_2 is larger than R_1.

RESISTANCES PLACED IN SERIES OR IN PARALLEL WITH POTENTIAL CIRCUITS

Per Cent Power Factor	Three-Phase Indicators		Two-Phase Indicators	
	Lag	Lead	Lag	Lead *
100	0		0 (R_2 open)	
95	0.47 R_1 with R_1	0.47 R_2 with R_2	2.04 R_2 with R_2	$\frac{R_1 \text{ across}}{3.04-(R_1/R_2)}\ R_2$
90	0.78 R with R_1	0.78 R_2 with R_2	1.07 R_2 with R_2	$\frac{R_1 \text{ across}}{2.07-(R_1/R_2)}\ R_2$
85	1.11 R_1 with R	1.11 R_2 with R_2	0.61 R_2 with R_2	$\frac{R_1 \text{ across}}{1.61-(R_1/R_2)}\ R_2$
80	1.53 R_1 with R_1	1.53 R_2 with R_2	0.33 R with R_2	$\frac{R_1 \text{ across}}{1.33-(R_1/R_2)}\ R_2$
70	2.87 R_1 with R_1	2.87 R_2 with R_2	0.02 R_2 with R_1	$\frac{R_1 \text{ across}}{0.98-(R_1/R_2)}\ R_2$
60	6.66 R_1 with R_1	6.66 R_2 with R_2	0.33 R_1 with R	$\frac{R_1 \text{ across}}{0.75-(R_1/R_2)}\ R_2$
50	0 (R_1 open)	0 (R_2 open)	0.73 R_1 with R_1	$\frac{R_1 \text{ across}}{0.58-(R_1/R_2)}\ R_2$ †
40	$\frac{R_2 \text{ across}}{7.20-(R_2/R_1)}\ R_1$	$\frac{R_1 \text{ across}}{7.20-(R/R_2)}\ R_2$	1.29 R_1 with R_1	$\frac{R_2 \text{ across}}{2.29-(R_2/R_1)}\ R_1$
30	$\frac{R_2 \text{ across}}{3.40-(R_2/R_1)}\ R_1$	$\frac{R_1 \text{ across}}{3.40-(R_1/R_2)}\ R_2$	2.18 R_1 with R_1	$\frac{R_2 \text{ across}}{3.18-(R_2/R_1)}\ R_1$
20	$\frac{R_2 \text{ across}}{2.10-(R_2/R_1)}\ R_1$	$\frac{R_1 \text{ across}}{2.10-(R_1/R_2)}\ R_2$	3.90 R_1 with R_1	$\frac{R_2 \text{ across}}{4.90-(R_2/R_1)}\ R_1$
10	$\frac{R_2 \text{ across}}{1.42-(R_2/R)}\ R_1$	$\frac{R_1 \text{ across}}{1.42-(R_1/R_2)}\ R_2$	8.95 R_1 with R_1	$\frac{R_2 \text{ across}}{9.95-(R_2/R_1)}\ R_1$
0	0		0 (R_1 open)	

NOTE—R_1 and R_2 are the normal resistances of the potential circuits. For a three-phase indicator R_1 and R_2 are nearly equal. For a two-phase indicator R_2 is larger than R_1.

* Some two-phase indictors have their potential coils brought out to four posts. Hence for leading power factors in this particulaar case it will be found more convenient to use the same data as for lagging power factors for two-phase indicators, but to reverse the direction of current in one potential coil.

† If negative, put $R_2/[1.73-(R_2/R_1)]$ across R_1.

By using this method the Philadelphia Electric Company is able to check in one hour's time an average of ten indicators, both two-phase and three-phase.

Comments.—As brought out in the foregoing, it is necessary, in order to obtain the required power factor (cos Θ) for three-phase indicators that the currents passed through the potential coils be proportional to $I_{p_1} \cos(\Theta + 30)$ and $I_{p_2} \cos(\Theta - 30)$ or $(I/R_1) \cos(\Theta + 30)$ and $(I/R_2) \cos(\Theta - 30)$. Mr. Varley must have dealt with instruments having the resistances of their potential circuits R_1 and R_2 equal, then I_{p_1} equals I_{p_2} and the currents that he passes through the potential circuits are then proportional to $\cos(\Theta + 30)$ and $\cos(\Theta - 30)$. The actual values of the resistances to be placed in series with the potential circuits are the same, however, regardless whether R_1 equals R_2 or not; but for the values of the shunts the ratio R_2/R_1 does not cancel out, as can be seen from the calculations made. For that reason the writer is not able to simplify the values of the shunts for three-phase indicators as given in the table from 40 to 0 per cent. If the ratio R_2/R_1 was to be taken as unity, it would only be duplicating Mr. Varley's work. Only when R_2 and R_1 are equal to within 1 per cent can their ratio be taken as unity.

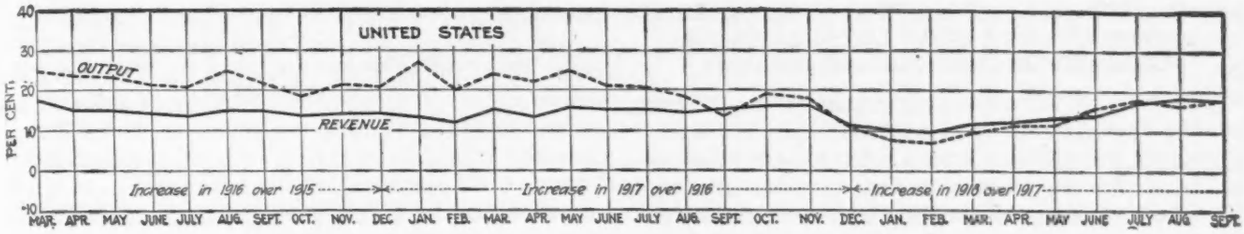
In general, the writer believes that the table given in this article is simpler than the one which was presented by Mr. Varley.

The values given for two-phase indicators in this table are entirely different from Mr. Varley's, the reason probably being that the latter applied to indicators having the current coil connected in the middle wire of a two-phase, three-wire line, whereas the writer refers to indicators having it connected in one outside wire. This latter connection is that of the Weston and General Electric types and is the most frequent. Here again the column for lagging power factors is a great deal simpler, since it gives the actual values of the resistances to be placed in series with either potential circuit from 100 to 0 per cent. The leading column is for the Weston class, leading factors for General Electric instruments being calibrated as for lagging factors, this being explained in this article.

An article will be presented later on the direct-current calibration of the Westinghouse indicators which operate on the principle of the moving vane. According to reports from Philadelphia, the method is proving successful in practical operation.

TO RETIRE the full war debt in twenty years would mean that the major part of the burden would fall on the present generation. I do not believe it would be either wise or necessary to hasten the process in so short a period. Industry needs an interval of moderate taxation in order to prepare itself for development and future uncertainties; the people should have a breathing spell in which to readjust their business interests to what will be new conditions. I would suggest that a sinking fund, perhaps a very moderate sinking fund, be established in due time, not to be large at least for several years after borrowing for war and after-war purposes comes to an end, always taking into account that industry must not be affected by the requisite taxation beyond a degree which it could bear. Later it might be entirely feasible to increase the size of the sinking fund.—*Jacob H. Schiff in New York Times.*

Central Station September Operations


UNITED STATES
OUTPUT
REVENUE
PER CENT.
40
30
20
10
0
-10
Increase in 1916 over 1915
Increase in 1917 over 1916
Increase in 1918 over 1917
MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT.

THE GREAT FACT IS THE CONTINUED LARGE INCREASE IN VOLUME OF OUTPUT

WITH returns from 48 per cent of the central-station industry, the September record is a gain of 18 per cent in revenue and of 18.1 per cent in kilowatt-hour output, as compared with September, 1917. This is roughly equal to the best record of any month in the year and indicates the heavy demand which the industries of the country continued to make upon the central stations at the beginning of the fall season. The rates of increase in revenue and output remain close together, and it is interesting to note that this condition has now lasted more than a year. In September, 1917, the rate of revenue increase was a trifle larger than the rate of output increase, and it was a fair deduction that rate advances were beginning to affect the returns. In the period which intervened between that date and September of this year the output and revenue curves crossed several times in the ELECTRICAL WORLD diagram, and from month to month it was somewhat uncertain which line would rise over the other.

Now with each month that passes the situation will tend to become more and more normal as peace-time production supplants the war industry demand. The return to the normal production condition will have one kind of effect upon central-station operations if it is accompanied by a reaction toward or to the old costs of materials and labor; it may have another effect if there is to be no change in costs of providing service.

The great fact which continues to shine in the returns is the large increase in the volume of production of the central stations.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
Oct..	62	$25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.5
Nov.	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.7
Dec..	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.0
		1918	1917		1918	1917	
Jan..	62	27,035,000	24,977,000	8.2	1,508,353,000	1,422,121,000	6.3
Feb.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.1
Mar.	60	25,396,000	22,702,000	12.3	1,418,222,000	1,294,561,000	9.4
Apr.	60	25,864,000	22,966,000	12.6	1,450,221,000	1,297,843,000	11.5
May	62	25,365,000	22,426,000	13.1	1,537,527,000	1,372,935,000	11.9
June	60	26,070,000	22,599,000	15.3	1,531,099,000	1,319,444,000	16.0
July	56	21,935,000	18,559,000	18.2	1,370,461,000	1,156,692,000	18.5
Aug.	58	26,891,000	22,690,000	18.5	1,647,510,000	1,417,150,000	16.3
Sept.	48	22,522,000	19,082,000	18.0	1,301,785,000	1,102,185,000	18.1

Based on the returns from 48 per cent of the industry, the ELECTRICAL WORLD estimate for the entire industry for September is: Revenue, $46,290,000; output, 2,712,-000,000 kw.-hr.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				Central States				Pacific and Mountain States		
		Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase
REVENUE	Oct.	64	$3,057,000	$2,530,000	20.7	66	$10,683,000	$9,173,000	16.5	52	$7,422,000	$6,304,000	17.8	85	$4,586,000	$4,327,000	6.1
	Nov.	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
	Dec.	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	3,393,000	2,990,000	13.8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8
	Feb.	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9.5
	March	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	18.0	84	4,560,000	4,321,000	5.5
	April	62	2,890,000	2,578,000	12.1	59	0,054,000	8,946,000	12.4	53	8,431,000	7,103,000	18.7	84	4,489,000	4,339,000	3.5
	May	62	2,810,000	2,530,000	11.5	64	19,929,000	8,613,000	15.3	53	8,217,000	6,956,000	18.1	83	4,805,000	4,327,000	12.0
	June	63	2,925,000	2,584,000	13.3	63	0,048,000	8,761,000	14.7	49	8,124,000	6,824 000	19.0	84	4,973,000	4,432,000	12.2
	July	62	3,037,000	2,511,000	20.9	62	19,278,000	7,961,000	16.5	42	4,998,000	4,116,000	21.4	88	4,622,000	3,971,000	16.4
	Aug	63	3,138,000	2,585,000	21.4	63	10,147,000	8,722,000	16.3	42	8,223,000	6,823,000	20.5	85	5,383,000	4,560,000	18.0
	Sep.	53	2,746,000	2,365,000	16.1	50	9,149,000	7,766,000	17.8	30	6,858,000	5,734,000	19.6	71	3,769,000	3,217,000	17.1
			1917	1916			1917	1916			1917	1916			1917	1916	
KW.-HR. OUTPUT	Oct.	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
	Nov.	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
	Dec.	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.3
	Feb.	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4
	March	62	121,518,000	111,576,000	8.9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April	62	117,416,000	101,888,000	15.2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11.4	84	399,126,000	372,465,000	7.1
	May	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12.3	53	441,202,000	404,560,000	9.0	83	462,372,000	406,797,000	13.6
	June	63	125,809,000	103,292,000	21.8	63	527,773,000	461,396,000	14.4	49	423,439,000	366,382,000	15.5	84	454,078,000	388,374,000	16.9
	July	62	135,960,000	105,373,000	29.0	62	518,566,000	439,464,000	18.0	42	254,189,000	216,296,000	17.5	88	461,746,000	395,559,000	16.7
	Aug	63	143,566,000	114,017,000	25.9	63	567,672,000	490,505,000	15.7	42	447,829,000	399,278,000	12.1	85	488,443,000	413,350,000	18.1
	Sept.	53	112,590,000	96,853,000	16.2	50	479,134,000	405,091,000	18.3	30	380,737,000	327,139,000	16.4	71	329,324,000	273,102,000	20.6

CONSERVATION OF WATER POWER IN NEW ENGLAND

Benefits of Conserving Power Through Storage Developments Discussed Before Special Legislative Committee on Conservation of Resources

The benefits of conserving water power through storage developments were discussed by a number of prominent engineers at Boston recently before the special legislative committee on the conservation of natural resources. Among the members of the committee are Chairman A. R. Weed of the Massachusetts Gas and Electric Light Commission, Chairman John N. Cole of the Massachusetts Waterways Board and Charles T. Main of Boston, consulting engineer.

The hearing was called with special reference to proposed storage developments on the Millers River, but during the session a general discussion developed of the benefits of storage in New England as a whole. The principal speakers were E. M. Whitney, Winchendon, Mass.; Guy M. Cox and William S. Whitney, counsel and chief engineer respectively of the American Woolen Company; W. Rodman Peabody, counsel for the Turners Falls Power & Electric Company; R. E. Barrett, general manager of the Connecticut River Conservation Company and engineer of the Turners Falls company; N. P. Avery, for the Holyoke (Mass.) Water Power Company; Arthur T. Safford, consulting engineer, Lowell, Mass., and R. A. Hale, principal assistant engineer Essex Water Power Company, Lawrence, Mass. Mr. Main also contributed to the discussion. The last-named speaker is a member of the engineering advisory board of the United States Fuel Administration, New England division. The speakers favored a comprehensive development of storage and stream-flow control under state regulation, though some differences of opinion arose as to the value of specific projects.

The development of increased power from the Millers River was first taken up by the committee. Mr. Whitney stated that in his opinion redevelopment of existing power sites as utilized would not increase the output of the stream over 10 per cent. He favored the construction of storage facilities, however, as a manufacturer using power, and expressed the opinion that state regulation of storage would be necessary. Without it, it is difficult to secure the largest possible use of the water for each and every power consumer.

Mr. Cox, for the American Woolen Company, stated that that organization is not interested in any further development of the river. He questioned the financial justification of a storage system. The company has a plant at South Royalston, 6 miles down-stream from Winchendon, and owing to the use of water by the Winchendon Electric Light Company and others, especially at night, the Woolen company, it was stated, cannot utilize the full flow of the stream.

Chief Engineer Whitney pointed out that on account of the demand for process steam it would be necessary to use about 70 per cent of the present coal consumption even if the full power of the river were continuously available. This figure is based upon the company's experience at the Washington Mills, Lawrence, when about 6000 hp. in steam-driven prime movers is shut down. At present there is no regulation in a broad sense of the stream flow in the Millers River.

Speaking for the Turners Falls Power & Electric Company, the second largest hydroelectric system in New England, Mr. Peabody favored a plan to establish storage reservoirs on the Millers River. This stream discharges into the Connecticut above the Montague City hydroelectric station of the Turners Falls company, and its equalization would be of value in the general supply of hydroelectric energy to central Massachusetts. The Cabot interests of Boston, operating the Turners Falls company, favor the development of a conservation plan by a private corporation under as strict state regulation as is necessary.

Mr. Peabody pointed out that coöperative, voluntary action rather than state development leads to the most satisfactory relations among the users of a stream. Storage development is a problem applying to seasonal conditions more than to the handling of twenty-four-hour load changes. Mr. Peabody said that the company's experience with storage has shown in a general way that it is practicable to pay for water passing through its wheels an approximate capital charge of $50 per 1,000,000 cu.ft. (28,000 cu.m.) of storage on a 58-ft. (18-m.) fall, or a yearly rate of about $4 per 1,000,000 cu.ft.

Mr. Barrett pointed out that the Turners Falls company is now coöperating in the building of storage reservoirs in New Hampshire and Vermont, and with promising results. On the Mascoma River, in New Hampshire, one-half the cost of storage development is being paid by the Connecticut River Conservation Company (formed by the New England Power Company and the Turners Falls Power & Electric Company), and the remainder by other beneficiaries.

Mr. Avery questioned the value of storage projects in connection with streams of the moderate size of the Millers River and the Deerfield River, with respect to large power-developing concerns situated in the middle Connecticut Valley. He contended that such developments are chiefly of local value, but said that the Holyoke company did not desire to oppose any broad program of betterment. He felt that the federal authorities or the various states of northern New England might well take up the development of storage facilities on a considerable scale in New Hampshire and Vermont.

Mr. Safford said that his experience indicates that it will pay to expend about $200 per 1,000,000 cu.ft. of storage where a 300-ft. (90-m.) development of the river can be attained. He cited a case in New Hampshire where it is proposed to develop 3,000,000,000 cu.ft. (85,000,000 cu.m) of storage. About 100 ft. (30 m.) of the fall is on a local stream, and the project cannot be made to pay merely as a local undertaking, but with users in Massachusetts meeting about half of the cost the plan appears feasible. To improve flowage conditions on a large river a very large amount of storage must be provided. Here is an important field for interstate coöperation. Mr. Safford said that various textile mills in Lowell are now replacing their older and less efficient waterwheels with modern units, in order to obtain additional power under their leases of power on the so-called "mill-power" unit basis and also as a fuel-saving measure.

Mr. Hale pointed out that waterwheels of 75 to 80 per cent efficiency are now taking the place in various instances of units formerly operating at 60 per cent.

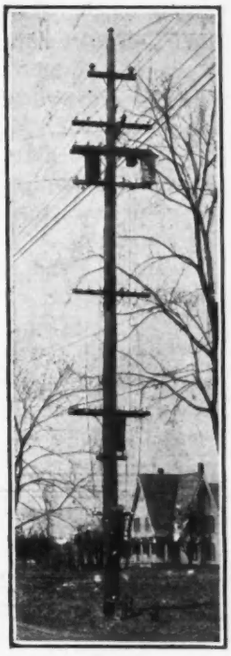
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

STREET-LIGHTING CONTROL MOUNTED ON ONE POLE

Transformer Fuses and Time Switch for Street-Lighting System in a Small Town Distant from Central Station Controlled Automatically

Complete control of a distant street-lighting system is obtained by a central station in the East by placing the necessary apparatus on one ordinary line pole. The energy for the system is transformed on the pole to the voltage required by the street-lighting systems by means of the transformers shown in the illustration produced herewith. Leads are connected to the fuses at the top of the pole and then to the time switch installed about 8 ft. (2.4 m.) above the ground so that it can be easily adjusted by linemen who inspect it regularly. From there the wires are connected to the transformer the secondary of which supplies the energy for the street lamps.



By this construction a control station is eliminated and the system is accurately controlled as to lighting and extinguishing of lighting at such times as have been predetermined.

METHOD OF PRESERVING DISTRIBUTION RECORDS

How Mass of Detail Necessary in Connection with Secondary System Is Kept by Department That Has No Space for Large Maps

The distribution department of the Topeka (Kan.) Edison Company has no convenient place to hang a large map; moreover, it is believed in the department that a large map filled with detail concerning the primary and secondary distribution circuits of a company becomes so blurred with finger marks that it soon loses the sharp detail which a good map should have. Nevertheless, the value of a good map was appreciated and an effort to prepare one that would be satisfactory was made. For this purpose the city was divided into eighteen districts and ten outlying semi-rural districts were also mapped. These maps were made by revising the official map of the city and dividing it into sections.

From the sections 22-in. by 30-in. ((55-cm. by 76-cm.) tracings were made, which gave a map on a scale of 300 ft. to 1 in. (3600 to 1). From the tracings the department had Van Dyke negative prints made, and from these negatives blueprints were taken. This produced a blueprint in which the lines were blue and the background was white. This combination was more satisfactory than a blue background with white lines for making notations, as data could more easily be seen on the white than on a blue background. These prints were bound in an oilcloth folder. On each print were shown all of the company's secondary lines, the location, size and number of all of the poles of all the public service companies in the city participating in the joint pole agreement, and the secondary lines of the Edison company, as well as the sizes of wire, transformer locations, lightning-arrester locations and types of lightning arresters. All this pertained to the secondary system; the primary system was shown in another set of maps.

This record is found to be very helpful in locating poles which customers want moved and, in fact, for finding out anything about the secondary system except the details of arming and wire position. It is not believed by J. E. Gosset, superintendent of distribution, that detail of such minute character is needed by a company in a city the size of Topeka. Such additional data as are needed are kept in a book.

MINIMIZING MOTOR TROUBLES MET WITH IN ROLLING MILL

Slight Overvoltage Will Sometimes Cause Serious Overheating if the Motors Are Operated Continuously at Their Top Rating

BY J. HUFF

In the press of his daily work the plant electrician is prone to forget that a liberal application of common sense will cure many of the ills to which electrical apparatus is heir. This fact is well illustrated by an event that recently occurred in a rolling mill engaged on government work and pushed to the limit of its capacity.

The mill had been operating on a twelve-hour-day basis until the necessities of the government dictated that the machinery be kept running during the entire twenty-four hours. A new shift was put on and everything moved along well for two or three days. Then the "tilting-table" motors, which were of the induction slip-ring type and up to this time had given satisfactory service, began to show marked signs of overload. Failure became frequent, the mill was subjected to periods of enforced idleness, the disposition of the chief electrician was adversely affected, and the maintenance men were kept so busy changing motors that they had little time for other considerations.

Finally there came a time when all the spare motors

were in the repair shop. Not only the mill hands but the maintenance men as well were forced to wait while motors were being rewound at a cost of $350 each. The situation evidently called for generalship, and the chief electrician detailed a man to give his entire attention to the relays which should have afforded protection for the motors in question, which were subject to the manipulation of the table operators. This arrangement proved unsatisfactory because of the antagonistic attitude taken by the head roller, who naturally resented any program that tended to slow down the rate of production in his department.

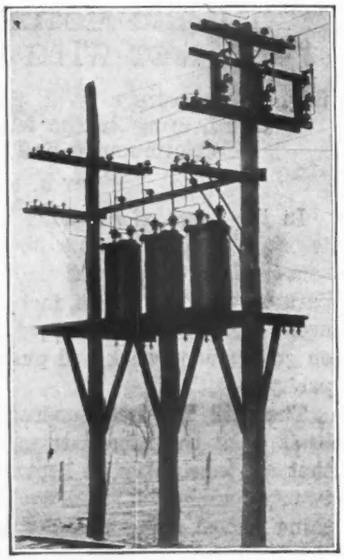
After spending something like $5,000 on motor repairs and wasting much valuable time it was decided to investigate the starting resistances. No trouble was apparent. In the course of this investigation, however, it was found that the supply voltage was somewhat higher than that for which the motors were designed, and the expedient of permanently connecting a little resistance in the motor leads was resorted to. In view of the conditions to be met the I^2R loss was negligible, and on the whole the solution of the problem was as satisfactory to all concerned at it was simple.

ECONOMICAL SUBSTATION BUILT ON RIGHT-OF-WAY

Transforms Energy from 11,000 Volts to 2300 Volts for Distribution in Towns Distant from Main Station—Three-Pole Construction Very Rigid

By constructing an outdoor substation on the transmission line right-of-way the Elmira (N. Y.) Water, Light & Railway Company has been able to serve a small town distant from the main power plant in an effective and economical manner.

The substation, as shown in the accompanying illustration, consists of three transformers mounted on a three-pole-supported platform, one pole of which is the terminus of the 11,000-volt line and the other pole the beginning of the 2300-volt consumer distribution feeder. Eleven-thousand-volt lines terminate in the tall pole, run through the knife switches and then are strung to the smaller poles. Taps are taken off these three lines to the transformer to form a delta connection.



SMALL TOWN SUBSTATION

The lead wires from the 11,000-volt bus to the transformer terminals are held rigid by three insulators mounted on a board fastened in a horizontal position to the two end poles. This eliminates any chance of the wires getting out of place. The 2300-volt lines start at the main pole and run to the opposite one and then to the distribution line. Connections are made to the secondary terminals of the transformer from these three lines.

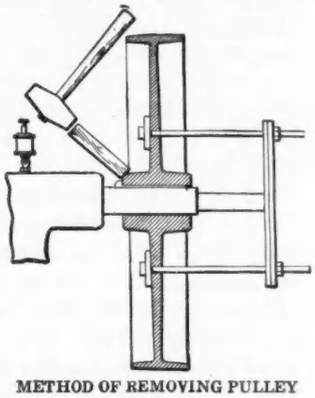
It happens that this substation is also on the railroad right-of-way, and the railroad feeders, telephone and signal wires are held in place beneath the platform by insulators. This prevents any danger of their coming in contact with the high-tension lines.

WAY OF REMOVING TIGHT FLYWHEELS AND PULLEYS

Use of Wedges or Gasoline Torch Will Usually Suffice and Home-Made Rigging Will Serve When the Former Fail

BY H. S. RICH

When it is necessary to remove a tight flywheel or pulley which it seems impossible to budge it is then that ingenuity more than sheer force is demanded if no damage is to be done to either the wheel or the shaft. First remove the set screws very carefully without wrenching off the heads. Then with proper-shape drifts drive out the key, marking it so that the small end may be identified for replacement.



METHOD OF REMOVING PULLEY

The trouble will likely begin now, so be reasonable and careful. The first mental impulse will probably tell you to get behind the wheel with as much leverage as possible and try to start it along the shaft. Sometimes this works, but too much force may spring the shaft or crack the bearing. Try a number of thin hard-wood wedges or iron shims if they are to be had and force them tightly behind the wheel on both sides of the shaft. While a helper taps on first one wedge, then the other, strike the hub of the wheel repeated blows so that it may start. In the meantime pour kerosene into the set-screw holes to let it work around the shaft.

If the wheel still refuses to move, apply two gasoline torches to the hub for a few minutes, being careful not to heat the shaft. This will expand the hub slightly, and then by striking the wedges it may be started a little.

If all these efforts fail to produce any effect, then a special rigging like one pictured herewith may be used. It consists of two flat plates to fit behind the spokes of the wheel each with a hole drilled through the center. Through these holes run square-head bolts about 12 in. (30 cm.) long, threaded for about 9 in. (23 cm.) of their length. Over the threaded ends slip two flat plates 3 in. (8 cm.) wide and 0.5 in. (13 mm.) thick with heavy nuts. Between the last plates mentioned and the end of the shaft place a piece of pipe or round bar 5 in. (13 cm.) long and with a heavy wrench turn first one nut then the other till the whole is tightened up and a pulling stress is exerted on the pulley. Help it along by hitting the rear of the pulley hub as the nuts are taken up. No wedges are now needed.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

NO CURTAILMENT MADE IN STREET-LIGHTING CHARGES

Full Amount of Contract Collected Because of Increased Cost of Glassware, Labor and Electrical Energy

The Clinton (Iowa) Gas & Electric Company operates an ornamental boulevard lighting system consisting of five-light electroliers on which the top lamp is burned only on Monday and Tuesday. The top lamps are 70-watt type C units and the bottom lamps are 40-watt units. The company gets $5 per month for these posts and has been able to collect the full amount because it pointed out to the city authorities the increased cost of glassware, labor and electrical energy. Practically no difficulty was experienced in doing this.

WAR-TIME PROBLEMS OF THE UTILITIES COMMISSION

Illinois Commission During Recent Period Confronted with Necessity to Speed Rate Cases and with Other Serious Problems

In a report on the war-time problems of the Public Utilities Commission of Illinois the engineering department of the commission reviewed the policies actuating the commission in its program of accelerating rate cases by shortening valuation and other time-consuming procedure. In addition it was stated:

In meeting the various service conditions during this period other problems have arisen of as serious a character as those involved in rate determinations. Utilities entered upon this period with certain definite equipment and plants for handling their business. Almost overnight in some cases they found themselves confronted with the necessity of furnishing largely increased outputs under heavily increased expenses in order to meet demands principally occasioned by industries connected with the production of war material. In some cases the plants of these utilities were incapable of meeting these conditions and giving satisfactory service to regular customers. These facts have been brought forth repeatedly in hearings before the commission and in informal matters which have not been placed upon the docket. These matters have been handled individually as each individual case has warranted.

In some cases the commission has gone to the extent of ordering an interconnection between utility properties for the purpose of making additional capacity available for the purpose desired. Numerous negotiations looking toward interconnection have been carried on informally, with results which have been quite satisfactory. In one case the commission has been called upon to differentiate between certain classes of consumers, indicating which class should have preference in calling for reserve capacity of utility equipment. In making such differentiation the commission was governed by the wishes of the national government as expressed in some of its priority orders.

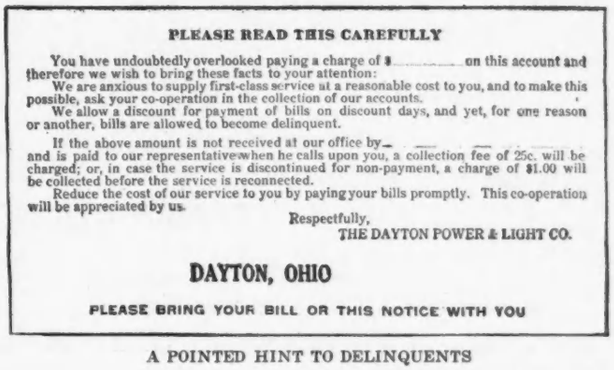
Regarding the future trend of utility rates and regarding the future methods best to be followed by the commission, considerable conjecture exists. We are bound to face the proposition that even with the declaration of peace and the return of our country to more normal conditions, prices and operating conditions will not immediately revert to their former basis, and it is extremely doubtful if they will ever revert to that basis. It is also to be anticipated that very different operating conditions will prevail in the future from those in the past. During recent periods the government has endeavored to instill in the public mind ideas of conservation to a greater extent than the American people have ever before attempted. These efforts of the government have been assisted by prevailing prices, which have offered great incentives to economy and adoption of labor-saving methods.

The question as a whole is a very large one, and time alone can tell in what manner its solution will be worked out. It appears certain, however, that during the next few years adjustments of utility rates will have to be made upon a very wide scale. It is not anticipated by the commission that these adjustments, which will be more or less upon a permanent basis, will be attempted under the methods which have recently prevailed. Neither party to the case, we believe, would be willing to follow such methods—at least in the completeness in which they have recently been adopted. It would appear that upon the return of conditions to a more normal basis adjustments of utility rates would have to be undertaken based upon a more complete investigation and a greater knowledge of the details which prevail. Further than this it is folly to predict.

STRICT POLICY ADOPTED TOWARD DELINQUENTS

Dayton Company Sends Out Only One Notice, After Which 25 Cents Is Charged if Collector Is Sent Out and $1 for Reconnection Charge

Owing to the increased costs of supplying service, the Dayton (Ohio) Power & Light Company has adopted the policy of charging 25 cents as a collection fee, when



PLEASE READ THIS CAREFULLY

You have undoubtedly overlooked paying a charge of $ ..... on this account and therefore we wish to bring these facts to your attention:

We are anxious to supply first-class service at a reasonable cost to you, and to make this possible, ask your co-operation in the collection of our accounts.

We allow a discount for payment of bills on discount days, and yet, for one reason or another, bills are allowed to become delinquent.

If the above amount is not received at our office by ____ ____ ____ and is paid to our representative when he calls upon you, a collection fee of 25c. will be charged; or, in case the service is discontinued for non-payment, a charge of $1.00 will be collected before the service is reconnected.

Reduce the cost of our service to you by paying your bills promptly. This co-operation will be appreciated by us.

Respectfully,
THE DAYTON POWER & LIGHT CO.

DAYTON, OHIO

PLEASE BRING YOUR BILL OR THIS NOTICE WITH YOU

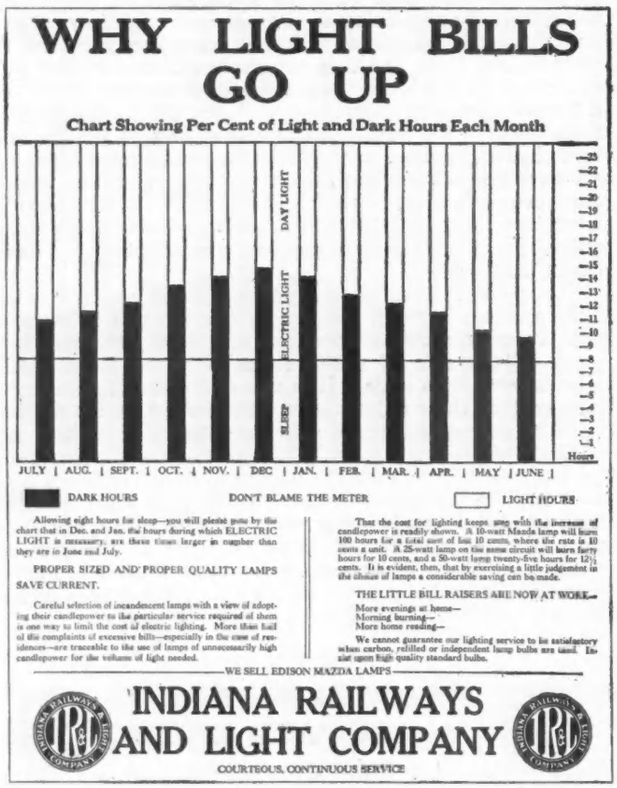
A POINTED HINT TO DELINQUENTS

a collector has to call, and a reconnection charge of $1. As a result of this policy the company has prepared a new delinquency notice as shown. This particular notice is the only one the company now sends out to its delinquent customers. At one time the company was sending out two notices to a customer before he was cut off for non-payment.

ANTICIPATING COMPLAINTS ON BILLS THOUGHT TOO HIGH

A Little Advertising in the Autumn Saves Hours of Explanation Later in the Year When Accounts Reach Customers

In preparation for the time when bills which will appear exceedingly high will be presented to its customers, the Indiana Railways & Light Company, Ko-


WHY LIGHT BILLS GO UP
Chart Showing Per Cent of Light and Dark Hours Each Month
DAY LIGHT
ELECTRIC LIGHT
SLEEP
JULY | AUG. | SEPT. | OCT. | NOV. | DEC | JAN. | FEB. | MAR. | APR. | MAY | JUNE |
Hours
DARK HOURS
DON'T BLAME THE METER
LIGHT HOURS
Allowing eight hours for sleep—you will please note by the chart that in Dec. and Jan. the hours during which ELECTRIC LIGHT is necessary, are three times larger in number than they are in June and July.
PROPER SIZED AND PROPER QUALITY LAMPS SAVE CURRENT.
Careful selection of incandescent lamps with a view of adopting their candlepower to the particular service required of them is one way to limit the cost of electric lighting. More than half of the complaints of excessive bills—especially in the case of residences—are traceable to the use of lamps of unnecessarily high candlepower for the volume of light needed.
That the cost for lighting keeps step with the increase of candlepower is readily shown. A 10-watt Mazda lamp will burn 100 hours for a total cost of but 10 cents, where the rate is 10 cents a unit. A 25-watt lamp on the same circuit will burn forty hours for 10 cents, and a 50-watt lamp twenty-five hours for 12½ cents. It is evident, then, that by exercising a little judgement in the choice of lamps a considerable saving can be made.
THE LITTLE BILL RAISERS ARE NOW AT WORK—
More evenings at home—
Morning burning—
More home reading—
We cannot guarantee our lighting service to be satisfactory when carbon, refilled or independent lamp bulbs are used. Insist upon high quality standard bulbs.
WE SELL EDISON MAZDA LAMPS
INDIANA RAILWAYS AND LIGHT COMPANY
COURTEOUS, CONTINUOUS SERVICE

HOW MIDDLE WEST UTILITY SEEKS TO EDUCATE CUSTOMERS

komo, Ind., uses advertising of the character shown here. In normal years many central stations have found it good policy to use this class of advertising in the fall. This year the necessity for it was all the more urgent because the change in the clocks accentuated the increase which usually occurs in electric service bills at this season.

THE LABOR SHORTAGE IN SMALL CENTRAL STATIONS

Under Present Conditions Manager of Small Company Is Harassed by Many More Difficulties than He Encounters in Normal Times

The shortage of labor is a problem which is giving the operators of small central stations no little concern. The smaller stations have never been financially able to employ the higher-grade engineers but have had to rely on one fairly competent chief for general supervision and two or three shift men combining the duties of engineer and fireman whose experience is limited to a working knowledge of threshing engines or like equipment. Often the job of chief engineer devolves on the manager with his other duties, and under normal conditions such arrangements have been found satisfactory.

Now, however, employees are restless and are demanding higher and higher wages and frequently leaving on short notice. Operators consequently must spend valuable time in training raw recruits, and equipment depreciates rapidly because of inexperience and neglect. Employees' bonuses for good and continued service have been successful to a degree but have not solved the problem. So serious has this become that some of the very small companies have curtailed their hours of service simply because they could not secure help with which to operate a twenty-four-hour schedule.

CITY REDUCES ITS FREE EXTENSION DISTANCE

Houston Company Now Has to Provide Only 100 Ft. of Line—Customer to Pay for All in Excess of This

A new ordinance has just been passed by the city of Houston, Tex., reducing the distance for which services must be provided by the electric light company in connecting up new consumers. The old ordinance provided for 300 ft. to the right or left of any service line, but the new ordinance reduces this distance to 100 ft. and specifies that anything in excess of 100 ft. shall be paid for by the customers. To take care of this new con-

APPLICATION FOR EXTENSION OF SERVICE LINES (ONLY)

The undersigned (hereinafter called "Consumer") hereby requests the Houston Lighting and Power Company 1905, its successors and assigns (hereinafter called "Company") to extend its service lines from its present terminus to the ..... of the Consumer, as shown in sketch on reverse side, and to furnish ..... phase, 60 cycle, ... Volt, ... C. Service.

In the event this application is accepted by the Company the same shall thereupon, but not until then, become a contract between the said parties, the terms, conditions and obligations of which shall be as follows:

(a) The Company agrees to construct and maintain the necessary service lines to serve the Consumer in accordance with the rules and regulations of construction and as outlined herein. (Consumer to make separate service contract.)

(b) The Consumer agrees, binds and obligates himself to pay to the Company the cost of the construction of such service lines (meters and transformers not included), in excess of 100 feet from the present terminus, as shown on sketch on the back hereof, and to sign the Company's regular service contract.

(c) The Consumer agrees to forward with this application the sum of $..... the estimated cost to the Consumer, of the construction of the necessary service lines.

(d) The Consumer hereby grants and gives to the Company, its successors and assigns, the sole and exclusive right and option to purchase all and from him the said service line so paid for by him, and this sole and exclusive option here now given and granted to the Company, its successors and assigns, shall remain and be in full force and effect so long as the service line shall be and remain in existence.

(e) In the event the Company, its successors and assigns, shall at any time exercise this option, then the Consumer agrees for himself and his heirs, executors and administrators, to convey the said line by general warranty deed, bill of sale, or any other instruments necessary to convey the title to the Company or to any person, persons or corporation which said Company, its successors or assigns may designate, and upon the Consumer executing and delivering such conveyance, the Company agrees, binds and obligates itself, its successors and assigns to pay in cash to the Consumer the original cost of constructing said line (it being the same amount paid by the Consumer to the Company), less, however, a depreciation of four per cent (4%) per annum, from the date said line is completed.

(f) It is expressly understood and agreed that nothing herein contained is to be construed as in any manner binding or compelling the Company, its successors or assigns, to take over and purchase the said line from the Consumer, but this paragraph (f) of this agreement means and is intended to mean that so long as the said service line shall remain in existence, the Company, its successors and assigns are to have and are now given and granted the sole and exclusive option to purchase the said line upon the terms and conditions hereinabove set forth.

(g) It is expressly understood and agreed that the service line constructed under the terms of this contract and to be paid for by the Consumer is and shall remain the property of the Consumer, and is and shall remain a private line, and by executing this agreement, the Company does not in any way agree nor bind itself, its successors or assigns, to supply electrical energy from this line to any other person or persons and will not supply any person or persons except upon written request from the Consumer herein, and upon the further terms and conditions that the person or persons requesting electrical energy to be supplied (which request has been granted by the Consumer) shall pay to the Consumer the cost of constructing the extension necessary to construct in order to supply such service, and the Consumer will thereupon pay in cash to the Company such sum of constructing the extension or extensions and the Company will not be required to furnish service until the Consumer has paid said amount to it.

The intention of the parties hereto being that the service line to be constructed under the terms of this agreement, and all extensions thereto, are to be paid for by the Consumer and remain his property until the Company desires to exercise its option to purchase the same.

This agreement extended to cover additional Extensions as follows:	Date	Length	Amt. Paid
Original Extension,			
1st Addition,			
2nd "			
3rd "			
4th "			
Total,			

ESTIMATED COST OF EXTENSION

Length of Extension		Ft.
Free Distance	100	Ft.
Distance to be Paid for by Consumer		Ft.
Estimate Total Cost		
Consumer's Pro Rata Part		

Estimates Subject to Correction on Completion of Work, and as Shown by the Company's Books

Estimator .....
Salesman .....
Date .....
Receipt is hereby acknowledged of payments as follows:
$ $ $ $ $ $

HOUSTON LIGHTING & POWER CO. 1905.
By ..... Secretary and Treasurer.

Consumer .....
Address .....
By .....

The above and foregoing application for the extension of service lines is hereby accepted this ..... day of ..... 19....

HOUSTON LIGHTING & POWER CO. 1905.
By .....

FORM FOR EXTENSION APPLICATION USED BY TEXAS COMPANY

dition and assist in making it perfectly clear to the customers, the Houston Lighting & Power Company has developed a new card form of extension contract, which is reproduced here. On this contract every detail covering the extension and its costs is carefully set forth, and it is proving a very helpful bit of system.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Size and Working Cost of Machines for Continuous-Current Transformation. — THOMAS CARTER. — This article discusses various methods of continuous-current transformation. The author (1) considers the differences existing between three schemes using a motor-generator and arrives at expressions for the relative sizes of these machines which are plotted in curves based on an assumed 100 per cent efficiency; (2) draws certain conclusions from these expressions and curves in regard to the first cost of the machines and their method of operation; (3) introduces corrections for the actual case when efficiency is not 100 per cent and deduces curves of over-all efficiency of transformation which show that the cheapest set to buy is also the cheapest set to run; (4) concludes by comparing a machine having a double-wound armature with a motor-generator as regards voltage regulation and by mentioning briefly certain well-known schemes for variable-speed motors which may be simply dealt with on the principles pointed out.—London *Electrician*, Oct. 11, 1918.

The Semi-Diesel Oil Engine.—JAMES RICHARDSON. —The author discusses the theory of the semi-Diesel oil engine as indicated by the following topics: Definition of the semi-Diesel engine, disadvantage of high compression, fuel economy, cycle of operations, flexibility, scavenging, injection, fuel, starting, reliability and regularity in operation. In conclusion, the writer states that the rapid extension within the last few years not only of the field of application but also of the size of engine and power developed per cylinder with semi-Diesel engines foreshadows considerable development in the near future. But practical difficulties would seem almost to confine the semi-Diesel engines to the two-stroke cycle. Developments toward improving the efficiency of scavenging and compression may well be expected.—London *Engineering*, Oct. 25, 1918.

Efficiency of Machines with Aluminum Windings.—G. SCHONWALD.—The question is considered whether aluminum is likely to be used as a material for the windings of electric machinery after the war, and calculations are made recording the changes in the dimensions of the machinery that would be necessary to obtain efficiencies as high as are obtained with machines having copper windings. Hitherto the requirements of the war have made it necessary to use existing frames and to replace the copper with aluminum in such a way as to obtain the greatest output with the smallest amount of material. This method is considered at length by R. Richter in his book entitled "Electric Machines with Windings of Aluminum, Zinc and Iron." It is now shown that machines of equal efficiency may be built with windings partly of copper and partly of aluminum. For instance, a direct-current machine may have armature winding of copper and field winding of aluminum. In this way about three-fourths to four-fifths of the copper may be replaced by aluminum. The aluminum windings contemplated are not the uninsulated ones that were already used before the war, but windings insulated in the same way as copper windings usually are. The question whether this machine would be able to compete commercially is difficult to decide at present, but on the assumption that the cost of the copper windings on the main and commutating poles amounts to one-half or three-fourths of the price of the cast-iron yoke and pole cores, the price of the aluminum windings should not exceed that of the copper windings for equal weights by an amount exceeding 30 to 45 per cent in order that the original copper machine and the modified aluminum machine should cost the same amount. It appears that there is some prospect of machines with aluminum windings being able to compete with machines with copper windings after the war.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Electrot. u. Maschinenbau*, May 26, 1918.)

Generation, Transmission and Distribution

Steam Turbines for Natural-Steam Power Plant at Larderello, Italy.—Mention has heretofore been made of the natural-steam power plant installed at Larderello in the province of Tuscany, Italy, and in the present article a description is given of the steam-turbine plant by which the supply of natural steam is utilized. In this region there is a constant emission of steam and hot water from crevices and fissures in the ground. In order to increase the output from these crevices holes were sunk to supplement the natural flow. Some of these holes are as much as 16 in. (40 cm.) in diameter and range in depth from 200 ft. to 500 ft. (60 m. to 150 m.). The supply was thus largely augmented, and on closing in the top of some of the bore holes it was found that the steam pressure reached about 45 lb. (22,000 kg. per sq.m.) gage. This observation led to the idea of utilizing the steam for power production. The plant for the utilization of this natural-steam supply consists essentially of three 2500-kw. turbines constructed and erected by Franco Tosi of Legnano, Italy. These turbines run at 3000 r.p.m. and are coupled to Brown-Boveri generators supplying three-phase current at 4000 volts and at 50 cycles per second. The turbines are of the standard exhaust steam type with reaction blading. Further details of the plant arrangement and equipment are given in the article.—London *Engineering*, Sept. 27, 1918.

Calculation of Inductive Circuits in Parallel.—FERNAND ERNSTEIN.—In this study the author shows that it is possible to treat by the method of complex quantities and without too long calculations the general case of n

inductive circuits in parallel and mutually influencing one another.—*Revue Générale de l'Electricité*, Oct. 19, 1918.

Tests and Measurements on Electric Lines.—LOUIS PUGET.—The classic method of measuring electrical resistances by means of the Wheatstone bridge necessitates the use of cumbersome and costly devices, can be employed only by experienced men and has technical objections besides. The author indicates two processes for measuring resistances and for locating losses to earth by methods of comparison. These methods, which can be carried out by the regular employees, require only a milliammeter and a commutator. In hunting for defects of insulation they permit immediate determination whether the defect is at either extremity of the line or in the intermediate part. If it is in the intermediate part, the calculation reduces itself into simple division.—*Revue Générale de l'Electricité*, Oct. 19, 1918.

Installations, Systems and Appliances

Automatic Three-Phase Switch.—W. ERNST.—Automatic switches are used for intermittent work, as with pumps and compressors, or in cases where some sort of distant control of the motors is used. In installations of considerable size there are complications owing to the necessity of bringing the rotor starter out of the short-circuit position. This means some difficulty with special reversing relays if the design is such that the auxiliary motor, which is generally used, changes its direction of rotation. A simplification, however, has been effected in a plan outlined in this article by which the auxiliary motor always rotates in the same direction.—London *Electrician*, Oct. 11, 1918.

Snook Apparatus for the Generation of High-Tension Unidirectional Currents.—RUSSELL S. WRIGHT.—The Snook apparatus consists essentially of a high-tension alternating-current transformer in conjunction with a rotating secondary commutator or rectifier, the latter being driven in exact synchronism with the periodicity of the current.—London *Electrician*, Oct. 4, 1918.

Storing Direct-Current Aluminum Arresters for the Winter.—F. T. FORSTER.—This article points out the ill effects of leaving the plates of an aluminum arrester standing in the electrolyte when out of service in the winter months. A satisfactory method of preparing arresters for storage is given, and if these instructions are followed no trouble should be experienced when putting the arresters back in service.—*General Electric Review*, November, 1918.

Electric Thermal Storage for Heating Rooms.—The article is based on the work of the Commission for Heating and Cooling Apparatus concerning the possibility of storing heat for room warming by utilizing surplus energy from hydroelectric stations during night hours when the demand for lighting and power is comparatively low.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Schweiz. Elektrot. Verein*, Bull. 9, June, 1918.)

Industrial Electric Furnaces.—JEAN ESCARD.—The author classifies the principal types of electric furnaces actually used in industry according to their method of operation, giving a summary description of them and indicating the conditions which should govern their installation and performance.—*Revue Générale de l'Electricité*, Oct. 19, 1918.

Electrophysics and Magnetism

Electrical Resistance of Porcelain at Different Temperatures.—R. G. ALLEN.—The resistance of eight samples of porcelain was investigated up to about 250 deg. C., three methods of measurement being employed. These involved the use of (a) a megger, (b) a high-resistance galvanometer, (c) a 0.005-mfd. condenser, the rate of leakage of which was determined by a Kelvin multicellular electrostatic voltmeter. Over the limited temperature range investigated it was found that the specific insulation resistance d and the absolute temperature T were related by the formula $\log d = a/T + b$, due to Rasch and Hinrichsen. a and b are constants for the material under consideration, and the author suggests that these may serve to identify the origin of the porcelain.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Royal Dublin Society Proceedings*, June 1918.)

Insulating Properties of Erinoid.—R. G. ALLEN.—Tests were carried out on different colored samples of erinoid and also on red vulcanized fiber with the object of comparing the properties of the two materials for insulating purposes. The author finds that in the case of tubes of erinoid the specific insulation resistance is higher when unprepared than when machined, and blonde erinoid has a higher specific resistance than any of the other varieties and higher than the red fiber tested. When dry, erinoid is a good insulator, but slightly hygroscopic, though not so much so as fiber. When its surface is not machined the resistance of erinoid depends greatly on the value of the applied voltage unless water electrodes are used. This dependence is very slight in the case of unmachined fiber either with mercury or water electrodes. But in the case of machined erinoid the resistance is almost indepedent of the voltage. Rasch and Hinrichsen's relation between temperature and resistance holds both for erinoid and fiber (over the range 0 deg. to 80 deg. C.).—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Royal Dublin Society Proceedings*, August, 1918.)

Hysteresis Losses for Direct-Current and Alternating-Current Magnetization.—L. DREYFUS.—The author discusses the results of Gumlich and Rose on the total losses in ring specimens magnetized by alternating current (*Abstract* 1098—1905). Gumlich and Rose expressed the losses as the sum of two terms, namely: $vnB^{1.6}$ and v^2fB^2, where v = frequency. The first term is the ordinary hysteresis loss, giving constant Steinmetz coefficient n. The second term is the eddy-current loss; f, however, is not constant, but diminishes to $B = 12{,}000$, and then becomes fairly constant. The author points out that there is no proper theoretical basis for the assumption of identity of static and dynamic hysteresis loops. The eddy-current loss being calculated, there is a further hysteresis loss which increases with v^2.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Archiv. f. Elektrot.*, 6, pp. 437-440, 1918.)

Instrument for the Analysis of Wave Shapes.—A. ROTH.—Resonance methods have been applied to the oscillograph to enable wave shapes to be analyzed, but this method involves the difficulties of use of the oscillograph. The instrument here described enables the magnitude of harmonics to be obtained directly by a reading on a dynamometer. The method of measurement is sim-

ple, no rotating parts are required, and the apparatus is suitable for use on high voltages. The principle of action is based on the properties of parallel oscillating circuits of different natural frequencies. After making a mathematical investigation of the characteristics of such circuits, the instrument is described. It consists of a dynamometer with two fixed coils and one moving coil. One of the fixed coils is connected across the line in series with a non-inductive resistance; the second is connected across the line in series with a circuit consisting of two parallel oscillating circuits with natural frequencies greater and less than that of the harmonic that is being sought; the moving coil is connected across the line in series with an oscillating circuit adjusted to the frequency of the harmonic. The two fixed coils are differential in their action. Under these circumstances, if the constants of the various circuits are suitably chosen, the instrument responds only to currents of the frequency of the harmonic to be measured, and its reading will be proportional to the magnitude of that harmonic. In the second part of the paper the details of the practical application of the method are considered, as well as the precautions necessary to eliminate errors due to the presence of harmonics other than the one being measured. The dimensions and construction of the instrument are given and the disturbing effects calculated that are introduced by the use of iron in the magnetic circuit, the self and mutual inductions of the coils, and by the change of the resistances of the coils owing to temperature variations. Lastly it is shown how the natural frequencies of the oscillating circuits should be adjusted. A number of wave shapes are analyzed by the instrument and by a mathematical method, and the results are found to be in good agreement. The instrument gives accurate values for harmonics that have a magnitude greater than 1 to 1.5 per cent of the fundamental. It is a drawback of the method that the phase relations of the harmonics are not determined.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Archiv. f. Elektrot.*, 6, pp. 359-376 and 388-406, 1918.)

Electrochemistry and Batteries

Electricity Releases Chemistry's Power.—JAMES M. MATTHEWS.—At the outbreak of the war imports from Germany were shut off and the nations were unpreparedly thrown upon their own resources. This condition and our entry into the war have resulted in our chemical industry growing as if by magic, and it is now our fourth largest enterprise. In this expansion electricity has played an important part, and in the maintenance of the industry on its new great scale electricity will be indispensable. Before the war the fixation of nitrogen had been carried on in Germany on a large scale by methods which had been kept secret, and Germany was enabled to store large quantities of nitrogen made by this process in addition to that obtained from the Chile saltpeter which had been accumulated. American chemists and electrical engineers have rediscovered these secrets and are now making nitrogen by these processes, greatly improved by American methods. It has been estimated that the production of nitric acid in the United States by next spring will be nine times normal. America will be more than independent in obtaining nitrogen compounds, especially as she can make synthetic nitrates cheaper than she can buy Chile saltpeter. To replace the supply of potash cut off from Germany American chemists and electrical engineers have shown the way to the potash in our lakes, slates, rocks and seaweed, and also how it can be precipitated electrically from the dust-laden waste gases of cement mills and blast furnaces. Formerly fully 90 per cent of our artificial dyes and colors which replaced natural dyes were imported. Our chemists have, however, not only made America the largest producer of natural dyestuffs in the world but have discovered upward of 200 artificial dyes which meet America's needs for acid, basic, chrome and direct dyes. The writer then continues to show how electrochemical products indispensable to warfare have been developed in this country. He also shows that chemistry's basic industry relies on electrical power.—*General Electric Review*, November, 1918.

Telegraphy, Telephony and Signals

Wireless Telegraphy System of the French Government.—J. B. POMEY.—The system of wireless telegraphy of Bouthillon consists of charging a condenser by a constant emf. The process consists in a rise in the charge on the condenser until a spark passes across the gap and discharges the condenser. This is again charged, and so on. The charging currents flowing at the moments of the breakdown of the gap tend to a limiting value, and when this is reached the condition of musical sparking is obtained. The equations of the system are worked out both for revolving spark discharges and for stationary gaps, and the stability of the operation is investigated.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Rev. Gén. d'Elec.*, May 11, 1918.)

Charging of a Condenser with Alternating Current.—J. B. POMEY.—The conditions that exist during the charging of a condenser shunted by a spark gap and fed from an alternating-current supply are examined from a mathematical point of view. The relations between the constants of the circuit are obtained for the maximum energy to come into play. In order that the sparks should pass in the same direction, the musical frequency must be half that of the supply. The value of the sparking voltage for the state of musical sparking is determined. It is probable that this corresponds to a very stable state.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Rev. Gén. d'Elec.*, July 6, 1918.)

Miscellaneous

Technics of Magneto-Magnets.—ELLIS H. CRAPPER.—It is generally agreed that the laws and characteristics of the magneto-magnet are not so well defined as those of the electromagnet associated with the design of an ordinary dynamo, in which soft iron and not hard steel is the material utilized. The complexities are accentuated in the case of permanent magnets of the magneto type in consequence of their special shape, which gives full scope to the introduction of irregular strains while the material is being cogged, rolled, bent, hardened, drilled and ground, operations which give rise to lack of uniformity in quality and hardness of the finished magnet. The author reviews the theory of permanent magnet properties and shows the application to the design of magneto-magnets.—London *Engineering*, Oct. 4, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

DR. GARFIELD RESIGNS AS FUEL ADMINISTRATOR

Resignation, Tendered to Take Effect at the Pleasure of the President, Is Accepted—To Care for Domestic Consumers

The resignation of Dr. H. A. Garfield as United States Fuel Administrator and its acceptance by the President were announced at the White House on Dec. 3.

In the official announcement it was stated that Dr. Garfield had tendered his resignation to take effect at the pleasure of the President. It was made clear, the announcement said, "that the needs of domestic consumers will continue to receive the attention of the Fuel Administration until the winter is past."

Washington advices said that Dr. Garfield would continue his work until the first of the year, but that he would then resume his duties as president of Williams College.

Dr. Garfield was called to Washington by President Wilson to take charge of the government control of production and distribution of fuel. The work was developed so that it dealt not only with production and distribution, but also with the economical use of different forms of fuel. It covered the question of prices, wholesale and retail, and comprised rigid supervision of larger users of fuel as well as educational campaigns among consumers.

TRANSFERRING THE WORK OF THE FUEL ADMINISTRATION

Assimilation of Some Departments of the War Organization Is Begun by the Bureau of Mines and the Geological Survey

After the close of a conference with Van H. Manning, director of the United States Bureau of Mines, and Dr. George Otis Smith, Director of the United States Geological Survey, United States Fuel Administrator Harry A. Garfield announced that the assimilation of some departments of the Fuel Administration would be begun soon by the two first-named government departments.

The statistical bureau of the Fuel Administration is to be taken over by the Geological Survey.

The work of the conservation bureau is to be taken over by the Bureau of Mines, which will continue the work of maintaining the quality of coal and improving processes of mining which has been developed by the Fuel Administration.

The Bureau of Mines also will take over the engineering program of the Fuel Administration looking to the development of electrical power at or close to coal mines.

The United States Fuel Administration, which will be terminated automatically upon proclamation of peace, will pursue its course with that end in view, relinquishing its various activities as they become unnecessary under armistice conditions, and continuing to function where its services still are required.

RESTRICTIONS ON PRICES AND ZONES FOR BITUMINOUS COAL

Production and Distribution So Satisfactory that Dr. Garfield May Abolish All the Restrictions—Anthracite Will Still Need Attention

Bituminous coal production and distribution have reached such a satisfactory point in relation to demand that he is contemplating the possibility of abolition of all price and zone restrictions on bituminous coal on Dec. 15, United States Fuel Administrator H. A. Garfield said on Nov. 30.

Anthracite distribution remains a problem that will require the active attention of the Fuel Administration for an indefinite period, he said. Other branches will so far have completed their work by Jan. 1 that only a nucleus of their organizations will be necessary after that date, Dr. Garfield said, so far as present circumstances indicate.

Why Labor Is High Nowadays

This is how the ELECTRICAL WORLD artist was impressed by the statement of S. B. Irelan, manager of the Montgomery Light & Water Power Company, a Doherty property, that he has solved the problem of why he cannot get negro labor at the gas plant at the old figures, if at all. Mr. Irelan submits in evidence an actual occurrence of recent date, to wit:

Negro Applicant—Boss, I hear yuh needs a stokah.

Boss—We do. Do you want a job?

N. A.—Yassuh. How much yuh pay?

Boss—You come to work to-morrow, and we will pay you what you're worth.

N. A.—I cain't do it, boss, 'caze Ah gets mo'an dat now.

ENGINEERING SOCIETIES TO HAVE EMPLOYMENT BUREAU

Decision of the Engineering Council—Replying to Letter on Reconstruction Commission, President Wilson Favors Existing Machinery

At a special meeting of the Engineering Council called on Nov. 21 to determine approximate limitations on its field of activity and to consider a working program, it was decided that an engineering societies' employment bureau should be established at once, principally to meet the new need which has arisen for an agency to aid engineers who have been in military service to find suitable positions.

The four secretaries of the founder societies of the United Engineering Society are appointed as the board of managers, and Walter V. Brown is made secretary in immediate charge. This action was taken as the result of the joint meeting held the previous day by the present secretaries and the American Engineering Service. The resolutions further provided that the American Engineering Service be instructed to turn over its entire office equipment and records and instruct its operating staff to report for further service to said bureau when organized, and that thereupon the American Engineering Service be automatically discharged. It was determined that the work should be started on the basis of no charge, with headquarters in the Engineering Societies Building, New York.

The work of the American Engineering Service was cited as having been of inestimable value to the government through the coöperation between the four founder societies and the government, and a resolution was passed expressing high appreciation of the accomplishments of George J. Foran and his associates during his chairmanship.

THE FIELD OF THE ENGINEERING COUNCIL

As defining its field of activity, the following resolution was passed: "The Engineering Council understands its field of activity to be approximately as follows: (1) The council may deal with any matter of general interest for which joint action of two or more of its member societies would have been appropriate if council had not been established. (2) The council may initiate and carry through projects of the general character defined in the bylaws for which the necessary financial provision has been made; but council shall not undertake expenditures in excess of appropriations for its uses made by the United Engineering Society on behalf of the founder societies and the contributions from other member societies, unless specific provision shall have been made therefor by subscription, donation or otherwise; moneys received by the Engineering Council shall be turned into the treasury of the United Engineering Society and disbursed by it for the purposes designated. (3) The council may take up and in its discretion act upon any matter of general interest referred to it by any member society or by any other society, national, state or local, or any branch of government, or by any individual or group of individuals."

It was further resolved "that the Engineering Council will as a rule avoid considering any matter which is specifically within the province of only one member society and not of the others."

A letter was addressed to President Wilson on Nov. 15 by J. Parke Channing, in which he said, in part:

"I am advised that you have under consideration the appointment of a reconstruction commission to develop a comprehensive program for the nation's conversion from a war to a peace basis.

"As chairman of the Engineering Council I respectfully ask that you consider the appointment of at least one engineer upon this commission, basing my recommendation upon the fact that all construction and practically all manufacturing is under the management of engineers."

Under date of Nov. 20 the following reply was received by Mr. Channing from the White House:

"MY DEAR MR. CHANNING: I have your letter of Nov. 15, which Mr. Rickard has been kind enough to hand me. You may rest assured that I realize what a service engineers can render in reconstruction problems from time to time. We are handling reconstruction questions just now by a process of consultation between existing instrumentalities, which I hope will prove useful and effective. Cordially and sincerely yours,

"WOODROW WILSON."

It was voted to abolish the War Committee of Technical Societies, and the chairman and members of the committee were thanked for their patriotic service.

United Electric Company Men Celebrate Victory

The employees of the United Electric Light & Power Company, New York City, met on Friday evening at the company's auditorium to listen to tales of the war. To the service flag of the company, containing 242 stars, four gold stars and one white star were attached with appropriate ceremony, and the moving picture "America's Answer" was shown.

CONCLUDING WAR WORK IN POWER APPARATUS

Gratitude Expressed for the Co-operation of Manufacturers—Varying Opinions Are Found in Regard to the Outlook for Business

In Bulletin No. 4, dated Nov. 30, of the electrical and power equipment section (of which Walter Robbins is chief) of the War Industries Board special thanks are expressed for the work of the war service group committees and the support given to their work. The bulletin follows:

Unless we are in receipt of some further commissions or requests from any of our war service committees, our work from now until our closing day, Dec. 20, will be confined almost entirely to making records of contracts which are to be canceled and in clearing up and properly arranging our files.

All restrictions imposed through this division having been now removed, we feel this will probably be our last and closing bulletin.

In many respects the relations with the various industries, particularly as represented by their war service committees, have given us great pleasure. Successful performance of the duties placed upon us would have been impossible without the hearty, patriotic and self-sacrificing support we have received throughout. We all feel we could not bid you an official good-by without special thanks to the members of these committees and to all of you an expression of appreciation of the manner in which you have supported these committees.

In some industries it has been necessary to apply restrictions against which we could offer no compensation by way of work of other classes. While, as has often been said, in many instances the acceptance of these restrictions, if the war were to be of great length, was almost equivalent to financial suicide, they have been accepted graciously and gracefully. Fortunately for all of us, most of the companies so restricted will be able quickly to regain their stride. That the duration of these restrictions in many cases was short-lived could not have been anticipated and does not in the least lessen our appreciation of the sacrifices accepted. In no instance has there been any holding back or failure to coöperate and support the moves that were necessary.

In Bulletin No. 3, dealing with readjustment matters, the section says under date of Nov. 26:

Final Conferences.—Many of the commodity sections are planning to hold final conferences with their war service committees. At the request of the industry in some cases restrictions will be continued. We have received no request from any of the industries handled by this division and may therefore fairly presume, and will presume in the absence of request immediately, that you do not desire restrictions maintained. We do not see, therefore, why we should call the war service committees to Washington and shall not do so unless you specifically request a meeting. Probably many of you will attend the Chamber of Commerce meeting at Atlantic City. All of you who do attend will probably be present at the meeting of the machinery group. We can arrange at that time for a meeting with all of you that desire so as to avoid a special trip to Washington. Unless we hear to the contrary, we will understand that to be the plan in all cases.

Brass Tubes.—All restrictions are being released to-day.

Cancellation Records.—Data as to proposals for cancellation are being cleared through the commodity section in interest. We are not concurring in these cancellations, but are, on the contrary, simply noting them and making records in case it should be found later that such records would be useful. In some cases we feel in position to make suggestions with reference to the cancellation, but these are in the minority. We are being asked what effect each given cancellation will have on the labor situation, but find ourselves unable to answer this question without referring to the company under discussion, so may be forced to obtain the data from you, although we think not.

Allied Purchasing Commission.—Of the total volume of unfinished orders placed through the allied purchasing commission we are unofficially advised that from 25 to 40 per cent will be canceled, this being very much lower than we at first thought.

Demobilization.—It has been found impracticable to undertake demobilization entirely by persons and occupations. When, however, any industry, or even individual factory, in any community can show a large proportion of its employees in any single unit, request for demobilization of that unit will be given every consideration.

Stock Bulletins.—Will each of you kindly make a definite note to cancel our names from your mailing list for stock bulletins? They now serve no useful purpose and simply make that much additional mail.

Questions.—If any of you have questions, please ask them as they will give us a line on the kind of information you would like to have.

Date of Completion.—We are unable to set an exact date, but unless called upon for services of other character than now being performed, we expect to finish our work and disband most of the organization of this division on Dec. 21. It will probably be necessary for some members of this little organization to return to Washington after Christmas, or to return more or less frequently for some time to come. Generally speaking, however, unless called upon for some new service, by the government or by you, we shall probably disband as an organization on that date.

Monthly Reports.—We now offer you definite release with the understanding that the December report, covering November, may be omitted and that you may abandon your own machinery for preparation of any future issues.

Circulars.—Priority and other circulars with reference to details and of particular interest to particular cases are constantly under preparation.

Business Situation.—We have been asked frequently for an expression of opinion as to the probable trend of business in the immediate future, to which our answer must be that we have been so thoroughly immersed in the war program that we are less competent to advise than you yourselves and therefore attempt no guess as to what lies before us. The demand for labor in certain industries indicates that they at least have no fear as to the future. Contrary to such opinions, obviously manufacturers of explosives and materials incident thereto have no great expectations for the moment. Between extremes there are varying opinions.

TAKING MEN MUSTERED OUT BACK INTO THE SERVICE

Executive Committee of Empire State Gas & Electric Association Recommends that Men Released by Government Be Re-employed

At a recent meeting of the executive committee of the Empire State Gas & Electric Association a resolution was passed providing that the association recommend to its members that they make provision to take back into their employ any who left to enter the service of the government either voluntarily or through the draft, as soon as such men may be mustered out of service.

Plan for Soliciting Outlet Business

A standardized plan of soliciting convenience-outlet business for electrical contractors everywhere, originated by the Society for Electrical Development for use in connection with the September campaign to "save fuel, food, time, labor, by wire," is being distributed to the trade by the society at a nominal price. The forms have been put up in lots sufficient for securing thirty jobs of housewiring or installation of service outlets

ENGINEERS SAIL UPON A MISSION IN FRANCE

Representatives of Four American National Engineering Societies Go at Invitation of French to Study Reconstruction Problems

At the invitation of the Société des Ingénieurs Civils and a committee of the French Engineers' Congress, and with the official approval of the French government, a delegation of American engineers has been appointed to study with French engineers certain problems involved in the industrial rehabilitation of France after the war.

This delegation was invited to go to Paris to examine in joint conference questions of the utilization of commercial ports, the development of navigable waterways, the development of water power and the improvement of road systems. Although these were the only subjects mentioned specifically, the congress will probably take up many other questions of development in which all engineers are directly interested.

The invitation was sent to the American Society of Civil Engineers and was accepted at once by cable, the acceptance stating that such a delegation would be organized in coöperation with the other American national societies.

The following delegates were appointed:

American Society of Civil Engineers—J. F. Case, chairman; George W. Tillson, George W. Fuller, A. M. Hunt, Nelson P. Lewis and George F. Swain.

American Society of Mechanical Engineers—Charles T. Main, president.

American Institute of Electrical Engineers—Lewis B. Stillwell.

American Institute of Mining Engineers—E. Gybbon Spilsbury.

The delegates sailed from New York on Dec. 5 on the Espagne.

Let Team Work Carry Us Through Reconstruction Dangers

BY WILLIAM H. WINSLOW
Vice-president Superior (Wis.) Water, Light & Power Company

THE armistice signed on Nov. 11, 1918, brought to a conclusion a war that had been waged for more than fifty-one months with steadily increasing violence and in which upward of twenty nations had become involved. And yet on Aug. 1, 1914, the belief was practically universal that no war between even two great nations could be carried on for as many as twelve months without being brought to a close by the financial and economic collapse that would be caused by the enormous expenditures involved. As we now know it was the theories of the economists and financial experts that collapsed, and it will be the part of wisdom to view with considerable skepticism any attempts to write in advance the economic history of the period on which we are just entering.

This, however, does not mean that because the fog is thick it will not pay to keep a sharp look-out ahead, and there are certainly already some reefs visible. Prominent among these is the wage question. We have had four years of increasing wages, and it is well to note that the bulk of the increases have been made voluntarily by employers, partly to meet increasing living costs and partly to hold their employees against competition from war industries. We are now presumably facing a period of declining prices for most commodities, including labor, but every effort should be made not to reduce real wages; in other words, to prevent money wages declining faster than living costs. Here it would seem is the most dangerous feature of the situation. We must apparently continue to feed a large part of the world for some time to come, which is likely to throw food prices out of line with the general economic situation of the country. As food averages something like 40 per cent of the wage earner's budget, it is clear that when wages have been advanced only enough to cover the increased cost of living no great reduction can be made while food prices remain where they are without causing trouble. Of course, the high wages paid in shipyards and other war plants greatly exceed the advances needed to cover increased living costs, and these can and must be reduced where the plants continue to operate. Here again it is well to note that in most cases these reductions will probably be made by the employed rather than by the employers. Just as during the last four years employers have had to advance wages to keep their men from taking other jobs, so now employees will probably have to take reduced wages to prevent other men from taking their jobs. All this, of course, is based on the supposition that the cessation of war work and the return of our army to civil life will make workers more numerous than jobs. If this does occur, it is difficult to see how any one can prevent the law of supply and demand from operating in the usual manner. An effort to hold the pendulum at the top of the present swing is likely to wreck the clock. It is very unfortunate that the average wage earner thinks of his earnings in terms of money rather than purchasing power, and if, as time goes on, nominal wages have to shrink in common with the price of other commodities, employers would do well to point out to their forces by means of charts that real wages—*i.e.*, purchasing power—have not declined.

Never has there been a time when it was more important for all elements of the economic structure to keep their heads and avoid any rash or arbitrary action in connection with the readjustments that must take place.

For the better part of two years now all of us have to a large extent ceased to think in terms of selfishness and united in the great common aim of winning the war. Let us hope that now that the war is won we can carry over into the reconstruction period enough of the feeling of team work to bring us safely through its dangers.

Business Men in Reconstruction Conference

Many Problems of Vital Importance to Industry Are Taken Up in Atlantic City Meeting of the United States Chamber of Commerce

BUSINESS men representing about 400 industries met at the reconstruction conference of the United States Chamber of Commerce in Atlantic City this week and considered the industrial problems brought by peace.

President Harry A. Wheeler of the organization asked if the United States should not lead in proposing an international plan for rationing basic materials and stabilizing their cost, so that the temptation to profit selfishly by the original ownership and control shall be replaced during the period of reconstruction by a broad recognition of the needs of all nations to reëstablish their productive power under as little restraint and as rapidly as the circumstances may permit. Making the plan and carrying it into effect, he said, should be left to those who best know the processes of production and distribution.

The principle of economic boycott is neither politically nor economically sound, Mr. Wheeler declared, nor is the principle of "favored nation" in commercial treaties. These would tend only to drive the nations further apart and increase the unrest in the industrial world.

An international problem of reconstruction is the use of the remaining ocean tonnage and of the new fleets as they leave their ways in the common service of all nations. Loss of shipping has, more than any other single factor, overthrown the normal operations of commerce and trade.

ATTITUDE OF PRESIDENT WILSON

Mr. Wheeler told of an inquiry sent by him on Nov. 23 to President Wilson, asking if it would not be desirable if American industry should name a thoroughly representative committee, particularly informed regarding the basic industries of the country, to be present in France during the course of the peace conference and available for counsel on such phases of the peace negotiations as may bear directly upon commerce and industry. In his reply President Wilson said:

"You may be sure that I would send a message to the meeting at Atlantic City if I knew what message to send, but frankly I do not. It is a time when we must all thoughtfully take counsel and apply the wisest action to circumstances as they arise."

The address of Mr. Wheeler also touched on the need of equitable readjustment of government contracts, the raw materials controlled by the government, the large holdings of machinery and commodities capable of being released for resale, price fixing, the treatment of new industries largely developed to supply commodities formerly imported from Central Europe, whether the right to combine should be extended to domestic operations, whether there should be consideration by Congress of all statutes constituting our anti-trust legislation and the relation of labor to the period of readjustment.

Mr. Wheeler read a letter which he had received from Bernard M. Baruch, chairman of the War Industries Board. Mr. Baruch said in part:

The War Trade Board and the Shipping Board are releasing restrictions upon imports and exports as rapidly as shipping is becoming available. Contracts with the government are being adjusted. In the meantime there must surely be some arrangement of business, but I am certain that the business man of America can and will meet the situation which confronts him.

The cancellations of contracts does not mean a repudiation of contracts, and the government of the United States will not, I am sure, take from the industry of the country anything to which it is entitled to under each and every contract. It will be the endeavor of the War Industries Board to aid to this end in every way possible.

MR. SCHWAB ON OUR MERCHANT MARINE

Charles M. Schwab talked of the great importance of a merchant fleet. He said in the course of his address:

Our great outlet for all our manufacturers must be foreign markets. How are we going to get into the foreign markets unless we have the ships and the mercantile marine to carry our goods to the foreign market? Therefore, gentlemen, it is our duty, it is the duty of every society, it is the duty of every chamber of commerce, it is the duty of every single individual, to raise their voices, to let their clamors be loud and long for the development and maintenance of this mercantile marine of ours.

The shipyards of the United States during the year 1919 are capable of producing with ease and economically between 8,000,000 tons and 10,000,000 tons of merchant ships. We will have produced in this year now ending somewhere between 3,500,000 and 4,000,000 tons. The United States has now under its control between 7,000,000 tons and 8,000,000 tons of ocean shipping.

With the 8,000,000 tons or 10,000,000 tons that we may add from our shipyards during the next twelve months, the United States will possess properly and economically operated a merchant marine that should make our industries secure and establish the greatest asset in this transition period from war to commercial work that, in my opinion, can be had. We ought, as manufacturers, every one of us, to impress upon everybody in Washington, with all the power that we have, as I repeat again and again, the important fact that the greatest step to help in this transition period is going to be the quick and permanent establishment of our foreign shipping ability.

We manufacturers have got to open our eyes to a wider vision of the present and the future with reference to our workmen. We have got to devise ways and means by which capital and labor, which have so often been termed synonymous, shall share equally. Not in theory but in practice we have got to devise ways and means of education. We must not only talk about these things but we must do these things. We have got to realize that many unjust remarks will be made by labor and they probably have been made by capitalists and employers in the past. That is one of the lessons this great war has taught us—true democracy. The thing we have to do is to teach, not patronize; to educate and have the American laborer know and feel that he can stand with his head in the air, as you can and as I can, and say with pride, "I am an American citizen."

Each manufacturer must study his own case and his own situation from his own standpoint and must know his own conditions. There can be no general rule that will be applicable to all. We ought to urge a continuance of work in every direction. Matters will adjust themselves industrially

in this country sooner or later by the natural course of events, but what we want to prevent is that sudden slip of the cog which will give us a social jolt that may be dangerous to our industries for years to come.

Secretary of Commerce Redfield urged American industry to beware of the temptation hastily to lay rash hands upon wages. He advised it to "concentrate thought, purpose and effort on output." Mr. Redfield said in his concluding remarks:

There is no doubt, humanly speaking, that prosperity lies ahead of America, but there is yet an unsolved doubt as to what use America will make of her prosperity. Do we think of our sister nations as twenty years ago a trust magnate thought of the concerns whose business he would like to grasp? We have outgrown that in our domestic commerce. I do not speak of it as being illegal—it is more illegal to-day in the minds of the business men than on the statute books—but when we get beyond that three-mile limit are we going to be as far advanced in our thought as we are at home? Can we carry the spirit of American law where the law of America does not prevail? If we do not, we may become fat and rich and possibly win the contempt of the world in so doing. Will our thought be to aid with a spirit of service running through all, serving those who have served us first? How will the world feel toward America twenty years hence? It all depends. If you can leave to your sons as they go about the earth the knowledge that America rose to a height of marvelous power, financial, military, political, industrial and economical, and she used that power to her own good always and also always for the good of the world, then your sons can walk as no German can walk, can travel the whole round orb of the globe, among friends knit to one another with bonds of esteem and affection which cannot be broken.

P. H. Gadsden, before the public utilities and electric railway group, discussed the difficulties of the electric railways, saying that what is needed at this time is "a thorough and impartial study of the whole question of electric railway franchise, with the end in view of establishing the industry on a wholesale economic basis which will guarantee continued efficient service to the public. Such a study should be made primarily from the standpoint of the public interest—what is best for the communities served. It is a national problem and not one for the owners of the railways alone or chiefly."

DOHERTY OPPOSES GOVERNMENT OWNERSHIP

Henry L. Doherty remarked before the petroleum group: "I do not believe in government control or government ownership. Government operation is inherently inefficient. If we are faced with government domination of business, it will be our duty to go back over the records and show what has occurred under government operation during the last year and a half."

A. C. Bedford, chairman of the board of the Standard Oil Company of New Jersey and chairman of the National Petroleum War Service committee, said that he could not agree "with that portion of President Wilson's message which deals with the employment problem. "Statistics show that a large percentage of foreign laborers in this country," he said, "are preparing to go to their native countries. They have made big wages during the war period and they are going back to work out the reconstruction problems in their own countries. I doubt if this will be offset by Europeans coming to this country." He said he did not fear that there will be idleness among labor because of inability to provide sufficient employment, but rather that there would not be enough labor.

SEIZURE OF CABLE LINES IS QUESTIONED IN COURT

Suit to Prevent Postmaster-General's Plan Is Begun in United States District Court—Grounds of the Complaint

A suit to prevent Postmaster-General Burleson from retaining, operating and amalgamating the cable lines of the Commercial Cable Company was begun in the United States District Court, New York, on Dec. 4. A bill of complaint was filed by Charles E. Hughes as chief counsel for the company. An injunction restraining the government from further control of the cable properties was asked pending decision on the law.

In the complaint Mr. Hughes recites the authority given by Congress on July 16, 1918, to the President authorizing him "during the continuance of the present war whenever he should deem it necessary for the national security or defense to supervise or take possession and assume control of telegraph, telephone, marine cable or radio system or systems or any part thereof and operate the same for the duration of the war, but not beyond the date of the proclamation by the President of the United States of the exchange of ratifications of the treaty of peace."

The complaint then quotes the President's words to Congress in which he "formally and officially announced the termination of the war." On Nov. 16 the Postmaster-General "announced informally through the public press that he had taken possession and assumed control of all marine cable systems" of American corporations. The complaint adds: "That his action was based on a proclamation of the President of the United States dated Nov. 2, 1918 (the actual date of execution being unknown to your orator, but your orator alleges upon information and belief that it was subsequent to Nov. 11, 1918). . . , That on or about the sixteenth day of November defendant issued an order, without date, assuming to take control of said cable system."

The bill attacks the seizure of the cable system on the ground, in part:

That the said seizure or attempted seizure of your orator's said cable system is unconstitutional, unauthorized, *ultra vires*, illegal and void, for the reasons that the war within the meaning of said resolution had terminated prior to the time of said seizure and the alleged authorization thereof; that the Congress had no power or authority under the Constitution to authorize the taking possession and control and operation of said cable system under the circumstances existing at the time of said seizure, and that said seizure was not reasonably necessary for the national security or defense; and that said seizure deprived your orator of its property without due process of law, and that said seizure took your orator's private property for public use without just compensation to your orator, and that said seizure was an unreasonable and arbitrary seizure, and that said seizure was not for public use, and that defendant is not an impartial tribunal to determine your orator's compensation for the use of said marine cables, and that proper and legal provision has not been made for the payment to your orator of said compensation, nor even for the keeping by your orator of the regular profits of its own property, and, finally, that the purpose, plan and effect of said seizure to unite, consolidate and unify your orator's said cable system with that of your orator's competitor, the Western Union Telegraph Company, is in violation of the anti-trust act of Congress of July 2, 1890, both in its immediate effect of suppressing competition now existing and in its effect in disorganizing your orator's organization, plant and equip-

ment, so as to disqualify your orator from taking up and resuming such competition when said cable system is returned to your orator on the signing of a treaty of peace and the proclamation thereof.

That the recent war referred to in said joint resolution is no longer in continuance, it having been terminated beyond possibility of renewal on Nov. 11, 1918, by an armistice; that said proclamation dated Nov. 2, 1918, did not become a proclamation and was not proclaimed or announced, signed, countersigned, made public or effective until after Nov. 11, 1918, namely, about Nov. 16, 1918, and that no seizure or possession of said cables was attempted, claimed or made until on or about Nov. 16, 1918.

That it is not necessary for the national security or defense that your orator's system of marine cables shall be seized, or taken possession of, or assumed control of by the defendant or any one else; that the national security or defense will not be furthered in the slightest degree by defendant taking possession and assumi .g control of your orator's marine cables; that the national security or defense was fully attained by the signing of said armistice and by the discontinuance of hostilities under the said present war; that a full, adequate, complete, quick and correct cable service has been during the period of the war and still is being given by your orator on its cable system to the government of the United States, and that all government messages are given precedence over all other messages, and that there has been no complaint or occasion for complaint on the part of the government in regard to the quick and accurate transmission of its messages, and that your orator's cables are worked and operated to their utmost capacity by a most competent staff of officers and cable operators, and that said service could not be increased or bettered, and that the operation of said cable lines by or under the control of the defendant would be less efficient and satisfactory not only to the government in the transmission of its cablegrams, but to the public in the transmission of public messages generally, and that the seizure of said cables on the ground that they were or are necessary for the national security or defense was and is a mere pretext without substance or basis of fact whatsoever.

ANNUAL CONVENTION OF MECHANICAL ENGINEERS

President Main Calls Attention to Work of Members in the War and to the Certainty that We Are Unprepared for Peace

The American Society of Mechanical Engineers held its thirty-ninth annual meeting in the Engineering Societies Building, New York, on Dec. 3 to 6. Charles M. Schwab and Orville Wright were made honorary members in recognition of their achievements.

President Charles T. Main said in his address that the members of the society were important factors in the solution of the numerous engineering problems that arose in connection with the prosecution of the war. He mentioned the work of the engineering service committee in furnishing specialists for the numerous demands of the government and the industries generally. The society has been very active in fuel conservation through its membership on the fuel conservation committee of the Engineering Council in coöperating with the Fuel Administration at Washington and by services of its members on the commissions of the various states.

In speaking of reconstruction problems President Main said: "It is now time to give careful consideration to the readjustment after the war, so that this country shall maintain its industrial and national integrity with due regard to our obligations to other countries. We were unprepared for war, which was a possibility, and we are unprepared for peace, which is a certainty.

"The future will have problems and trials. The contests will not be of battles but of industry. The conquests will not be of territory or thrones but markets. Plans have been under consideration for some time past in England, France and Germany for regaining the commerce lost during the war. Upon our ability to resume our normal lines will depend to a large degree our prosperity at home and our trade expansion abroad. We were unprepared for war, and it was a stupendous task to readjust our industries to a war basis. It will be no easy task to readjust ourselves for peace. In this readjustment our vision must extend beyond the state and the nation out into the broad world. Bills have already been presented in Congress for the creation of a federal commission on reconstruction."

The following officers were elected: President, Mortimer E. Cooley, Ann Arbor, Mich.; vice-presidents, F. R. Low, New York; Henry B. Sargent, New Haven, Conn., and John A. Stevens, Lowell, Mass. William H. Wiley, New York, was re-elected treasurer.

TERMINATION OF THE WAR INDUSTRIES BOARD

With the Resignation of Bernard M. Baruch as Chairman, the Board Will Cease to Exist on the First of January Next

In accepting the resignation of Bernard M. Baruch as chairman of the War Industries Board, effective Jan. 1, President Wilson has agreed that the board shall cease to exist on that date.

Mr. Baruch said that the facilities of the board had been put at the disposal of the various contracting agencies of the government and that the activities believed to be of lasting value were being transferred to permanent departments of the government where they might be carried forward. He suggested that the various heads of commodity divisions might render much valuable assistance in the future as trade advisers to the Department of Commerce and the War Trade Board. The President indicated that he concurred.

ASK COMMISSIONS TO LESSEN REQUIREMENTS IN ACCOUNTING

Public Service Commissions Requested by Executive Committee of the N. E. L. A. Accounting Section to Lighten the War Burden

The executive committee of the Accounting Section of the National Electric Light Association has passed resolutions asking the public service commissions to lessen their requirements upon the companies in the way of annual reports. This request is made because of the serious depletion of trained forces in the accounting departments, the number of untrained employees and the heavy expenses of every character to which the companies are subjected. The commissions are asked to reduce their requirements for at least one year.

W. J. Meyers, secretary United Electric Light & Power Company, New York, and chairman Accounting Section's committee on form of annual reports to commissions, circulated the resolutions.

URGES ELECTRIFICATION OF THE CALIFORNIA RAILROADS

Representative of Oil Division of Fuel Administration Points to Oil and Capital Economy—Purchase of Power

Electrification of the mountain division of California railroads has been recommended to Director-General or Railroads McAdoo by D. F. Folsom, director of the Pacific Coast section of the Oil Division of the Fuel Administration, as a means of conserving fuel oil and reducing the operating expenses of the sections of the railroads involved by $4,923,300 a year. The recommendation, based on the report of W. F. Dietrich, engineer of the Oil Division of the Fuel Administration, shows that the electrification of 510 miles of railroad would mean an annual saving of 3,062,000 barrels of fuel oil, the total cost of which is $6,147,000, and that the cost of power to operate the trains over these sections at 0.75 cent per kilowatt-hour would be $2,000,000, indicating a reduction in the bill for motive power of $4,147,000 annually. The first cost of the electrification is placed at $23,012,000, on which there is estimated an annual profit of 9.4 per cent, after allowing for depreciation, amortization, taxes and interest.

The railroad divisions affected by the recommendation are the Sacramento division of the South Pacific, 157 miles from Roseville, Cal., to Sparks, Neb.; the Shasta division of the Southern Pacific, 215 miles from Gerber, Cal., to Ashland, Ore., and the San Joaquin combination division of the Southern Pacific and Santa Fé, 138 miles from Bakersfield to Saugus.

With oil valued at an average figure of $2.02 a barrel and electricity at 0.75 cent per kilowatt-hour (a total of $2,000,000), the annual saving in the cost of power is $4,147,000 in favor of electrification. The purchase of hydroelectric power is contemplated throughout the report, but it is pointed out than even if the electricity were generated by oil there would be a saving of about half the consumption of oil now used as locomotive fuel. Thus 267,400,000 kw.-hr. at 200 kw. per barrel would require 1,337,000 barrels of oil, or 43.6 per cent of the present consumption of locomotive fuel in the three districts. But if oil were used, it would cost $700,000 more than the cost of hydroelectric power at 0.75 cent per kilowatt-hour, the report states.

The following table gives a summary of the power required and the fuel oil saved by the proposed electrification of the divisions considered in the report:

Division	Kw.-Hr. per Year	Maximum Kw. Demand
Sacramento	104,200,000	47,600
Shasta	73,200,000	33,400
San Joaquin	89,000,000	40,000

The saving of oil in each district, according to the report, would be:

Division	Barrels	Value
Sacramento	978,000	$2,200,000
Shasta	907,300	2,055,000
San Joaquin	1,177,000	1,882,000

The comparative low value of the oil used in the San Joaquin division as shown in the foregoing tabulation is due to the proximity of the district to the largest producing oil fields in California, making it possible to supply steam locomotives with fuel at a much lower rate than in the other two cases considered.

For the purpose of comparison, the following figures of fuel-oil consumption by the Western railroads during 1917 are given in the report, together with the percentage that would be saved by electrification of the three divisions recommended in this report. In determining the amount of fuel oil that would be saved on the mountain divisions of the Southern Pacific company it was found that the method of calculating these figures varied with the data available for each district, but the final results are stated to be 90 per cent accurate:

	Barrels	Per Cent Saved
Southern Pacific	15,696,354	....
Santa Fé	5,856,901	14.22
All Western railroads	24,394,247	12.6
Total for California	10,450,000	29.3
Total California fuel-oil production	78,000,000	3.93

A summary of the first costs, the percentage of profit on the investment and the annual saving obtained in each of the three districts considered in the report is given as follows:

Division	First Cost	Annual Saving	Per Cent
Sacramento	$8,100,000	$1,592,600	7.6
Shasta	8,038,000	1,903,800	11.7
San Joaquin	6,784,000	1,426,900	8.7
Total	$22,912,000	$4,923,300	9.7

In calculating the profit on the investment in the report 12 per cent is allowed for depreciation, amortization, taxes and interest.

No recommendation or suggestion concerning the source of the supply of power is contained in the report. Mr. Folsom stated, however, that should his recommendation be adopted generating stations would have to be built to meet the demand.

Southern California Contractors and Dealers Help the Boys

Soldiers and sailors' "auto courtesy signal systems" were erected throughout southern California by the Southern California electrical contractors and dealers.

G. E. Arbogast, president of the association, wrote to the ELECTRICAL WORLD that while it was believed by many people that this device is a valuable invention it was not patented and the association was glad to furnish details to any one who desired to use it for patriotic purposes. The cost figured close to $10 each, erected.

WAR SERVICE ACTIVITIES OF ILLUMINATING ENGINEERS

Government Appreciation Expressed—More Rugged Tungsten Lamps to Be Produced—Psychological Effect of Lighting Curtailment Emphasized

Preston S. Millar of New York and Harold Almert of Chicago were speakers at a joint meeting of a group of engineering societies in Chicago Nov. 25. Mr. Millar told of the activities of the war service committee of the Illuminating Engineering Society and of the appreciation of its work which had been expressed by government officials. In talking about the types of lighting the committee had studied the speaker divided his subject in four parts, namely, lighting for production, lighting for protection, lighting for safety, and the promotion of conservation by the elimination of non-essential lighting. In all types the prime considerations have been intensity, direction and degree of diffusion.

The speaker brought out several matters of news interest in his discussion. Not the least of these is that a new and more rugged tungsten lamp with a braced filament is being brought out to replace carbon and "gem" lamps. In this connection he reproduced a table which showed that between the years 1912 and 1917 the demand for carbon lamps had fallen off in this country from 59 per cent of the total to 13 per cent of the total. Among the members of the Association of Edison Illuminating Companies the decrease in the same period was from 75 per cent to 10 per cent. In Chicago the ratio was 9 per cent in 1916 and 5 per cent in 1917. The speaker also said that a study of coal-mine lighting is being made with the expectation that a method of mine lighting may be developed which will make production more rapid. Data collected by insurance companies were cited to show that while good lighting has decreased industrial accidents somewhat, still 18 per cent of industrial accidents are attributable to poor lighting. Dwelling on safety considerations, he discussed unwise curtailment, particularly in industrial plants. A further measure of curtailment in semi-public places such as stores had been planned for this winter, but the signing of the armistice will probably prevent its being carried into effect.

In discussing lighting curtailment Mr. Millar brought out very clearly that the psychological effect of dark signs and dark show windows was just as much sought as was the result in actual coal saving. He also expressed the opinion that daylight saving as a fuel conservation measure fell far short of what was expected from it by its sponsors.

In closing he paid a high tribute to the public utility men who accepted the sacrifices asked of the industry in such whole-souled patriotic spirit. He also related how the point of view of the war service committee of the Illuminating Engineering Society had changed during the period of its life. At first it was prone to oppose restrictions on lighting. Later, however, its point of view became changed so that in all questions it was able to look at its problems with consideration for promoting the war ability of the nation first, the welfare of the public second, the success of the lighting industry third, and other industries fourth.

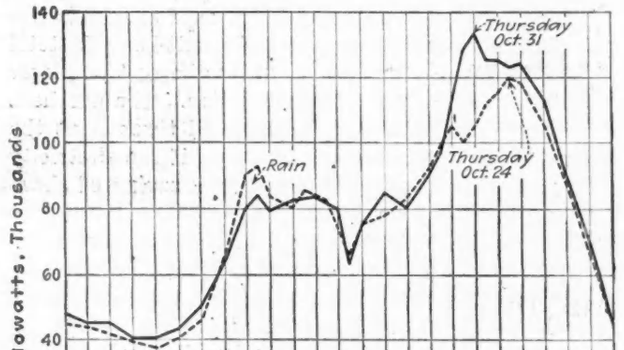
Mr. Almert in his address outlined the activities of the Illinois Fuel Administration, pointing out some of the instances in which interconnection of public utilities had been urged in the interest of coal economy. He stated that there is now no danger of a coal shortage in Illinois but urged all engineers to continue to promote economical practices.

MERCHANDISING MEN PLAN ANOTHER PORTABLE CAMPAIGN

Heads of Principal Central-Station Commercial Departments Will Meet in Connecticut to Plan the Sale of 50,000 Lamps in 1918

The group of central-station men which has recently been engaged in marketing a standard type of portable reading lamp has announced that this first campaign was a marked success and that another is now being planned. On Dec. 6 the group met at the Hotel Taft, New Haven, Conn., for a dinner and a preliminary discussion of plans. On the next day they were to drive to the factory of the Edward Miller Company, Meriden, Conn., to complete arrangements for the sale of approximately 50,000 portable lamps in 1919. It is probable that the retail price of these lamps will be considerably higher than the price which was in effect this year. In 1918 the standard lamp sold for $6.75. The lamps which will be handled in 1919 will probably retail at between $12 and $14 each.

How Clock Change Affects Chicago Company



Two Thursdays as nearly alike as to weather and other ruling conditions as possible but differing by the recent "setback" in the clocks were chosen to show the effect of the change in time on the load of the Commonwealth Edison Company of Chicago. In the mornings very little difference in the character of the two curves developed. Except for a short, sharp peak attributable to rain, there is no difference until the hour of sundown. Then the overlapping of the lighting in the offices and the industrial power causes a steep rise of about 30,000 kw. The net increase in demand, however, is somewhat less, being around 15,000 kw. The average consumption is greater on Oct. 31 than on Oct. 24 by an amount in excess of 44,000 kw.-hr. These curves and data are all based on the company's 60-cycle load alone. They do not include any of its 25-cycle railway load. The curves are thought to be particularly interesting as they indicate that in the autumn of the year a saving could still be made by continuing on the summer-time schedule.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

New York Jovian League.—At the meeting of the New York Jovian League held Nov. 26 Henry J. Carroll of the New York Telephone Company gave an illustrated lecture entitled "On the Battle Line with the Telephone."

A. I. E. E., Fort Wayne Section.—Capt. R. N. Vyvyan of the British Royal Air Force told the Fort Wayne Section, A. I. E. E., Nov. 21, of experiences at the front with wireless telegraph and telephone apparatus in artillery coöperation.

Officers of Chicago Electrical Credit Association.—At the twenty-third annual meeting of the Electrical Credit Association of Chicago, held at the Hotel La Salle, Nov. 21, H. E. Wilkins of the Belden Electric Manufacturing Company was elected president for the ensuing year.

Cleveland Engineering Society.—On Nov. 26 the Cleveland Engineering Society was addressed on the subject "Inventions Helpful in Winning the War" by J. F. Oberlin, patent attorney of Cleveland. On Dec. 3 Willard Beahan addressed the society on the subject "War-Time Labor."

Southwestern Electrical and Gas Association.—The second quarterly conference of the Southwestern Electrical & Gas Association has been set for Monday, Dec. 9, at the Hotel Bender, Houston, Tex. The program is to be announced at a later date. S. R. Bertron is chairman of the committee.

Institute of Radio Engineers.—On Dec. 11 the Institute of Radio Engineers will hold a meeting at the Engineering Societies Building at which Charles S. Ballentine of Philadelphia, will read a paper on "The Operational Characteristics of Thermionic Amplifiers and a Dynamic Method of Determining the Mutual Conductance."

A. I. E. E., Urbana Section.—At a meeting of the Urbana (Ill.) Section, A. I. E. E., held Nov. 20 the election of officers for the coming year was announced. A. R. Knight was elected chairman and E. H. Waldo secretary-treasurer. It was decided that no meetings shall be held this winter unless the S. A. T. C. is mustered out.

A. I. E. E. Schenectady Section.—Prof. C. A. Adams, president of the American Institute of Electrical Engineers and chairman of the electric welding committee of the Emergency Fleet Corporation, will deliver an address, "Electric Welding with Special Reference to its Application to Shipbuilding," before the Schenectady Section, A. I. E. E., on Tuesday, Dec. 10.

A. I. E. E., Lynn Section.—At a meeting on Nov. 20 of the Lynn Section, A. I. E. E., M. O. Troy read a paper entitled "The Transformer Industry and Some of Its Problems."

Electrical League of Cleveland.—At the Nov. 27 meeting of the Cleveland Electrical League Richard F. Grant spoke on the probable business conditions in the immediate future. The subject of his paper was "The Direction of the Wind."

National Association of Electrical Contractors and Dealers.—Comprehensive plans for the improvement of trade relations were outlined by W. H. Morton, general manager of the National Association of Electrical Contractors and Dealers, at a meeting of the Massachusetts branch of the association in Boston last week. Mr. Morton stated that a program was being considered for the realization of coöperation throughout the electrical industry.

Engineers' Club of Philadelphia.—The regular monthly meeting of the Engineers' Club of Philadelphia will be held Tuesday, Dec. 17, at Witherspoon Hall. Frederick K. Morris of Columbia University will read a paper on "The Fourth Year." which will be illustrated with motion pictures and lantern slides illustrating activities in the war zone. On the same day at the Tuesday noon luncheon of the club Commander F. G. Coburn, U. S. N., manager of the naval aircraft factory at the Philadelphia Navy Yard, will speak on the subject of "Aëroplane Construction."

Western Society of Engineers.—S. J. Duncan Clark of the Chicago *Evening Post*, speaking before the Western Society of Engineers at Chicago on Nov. 18, dwelt at some length on reconstruction problems as well as on a trip to the western front. He predicted that England will become a leader in social democracy. His opinion in this matter is based on judgments formed after viewing in England the preparations for amicable relations between employers and employees, through governmentally sanctioned committees of workmen and employers organized by industries. In France not so much work has been planned in this respect.

Three Hundred and Forty-second Meeting of the A. I. E. E.—The Philadelphia A. I. E. E. meeting has been set for Dec. 13 and 14. The two principal papers for Dec. 13 are "The Use of Electric Power in the Mining of Anthracite Coal," by J. B. Crane, and "Drum Shape as Affecting the Mine-Hoist Duty Cycle and Motor Rating," by F. L. Stone. The evening session will be devoted to research discussion. R. A. Millikan will address the meeting on the subject of "Research in America after the War," and W. R. Whitney will speak on "American Engineering Research." Saturday morning, Dec. 14, will be devoted to a technical excursion to the shipbuilding plants on the Delaware River.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate Increase at Homer, Ill.—The Illinois Public Utilities Commission has authorized a temporary increase in rates for the Homer Electric Light & Power Company, which it is figured will give a yield of 7 per cent on a valuation of $30,000. The lighting rate on a sliding scale of four steps ranges from 17 cents to 9 cents per kilowatt-hour with a $1 minimum bill.

Commission Upholds Pooling of Power Production.—Through stock ownership, the Alton Gas & Electric Company and the East St. Louis Light & Power Company in southern Illinois are controlled by the same interests and are under the same management. These companies filed application on April 17, 1918, for increase in rates for power service. The Illinois Public Utilities Commission by a temporary order on July 29, 1918, authorized the rates proposed to become effective July 1, requiring reparation if lower permanent rates were fixed. The East St. Louis Light & Power Company operates a generating station in Alton, and the East St. Louis Suburban Railway Company, which is under the same management, operates a generating station in East St. Louis. These stations are jointly supplying energy to the territory. The third source of energy lies in the circuits of the Mississippi River Power Company, which are connected with the East St. Louis Light & Power Company. Several other companies operating in this district are affiliated with these companies in stock ownership, and these three sources of power supply are all pooled and the expense of the power divided between the companies. The city of Alton in opposing the proposed rates contended that since the most efficient station is in Alton the consumers there should receive the benefits of the cheaper generation from this plant, and that the cost of production of the three power sources should not be considered by the commission in fixing rates for Alton. The commission held that a generating station in Alton was not more advantageous than one in East St. Louis, the location of the station in either place having the same advantages as regards facilities for freight shipment, water and labor supplies. While the Alton station appears to be in better physical condition, the advantages of the combined production of power for these companies seem very apparent. The commission was of the opinion that no material injustice is done by the pooling of the means of production by these companies.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Honor Roll of the Associated Manufacturers.—On March 1, 1918, the honor roll of the Associated Manufacturers of Electrical Supplies numbered 14,656. This number has been greatly increased, and Charles E. Dustin, the general secretary, writes members that there is a general desire that a new honor roll be prepared showing the total number that have entered the service of the government from the beginning of the war to the day of victory, as well as the number of those who have given their lives to the great cause of humanity. For this purpose blanks have been sent to the members so that additions may be made to the service flag and an early report prepared.

Rate Increases to Utilities.—Commenting on the public utility situation, Arthur S. Huey, vice-president of H. M. Byllesby & Company, says: "Every one realizes that the operating costs of electric and gas companies have increased tremendously, and we appreciate the attitude of the public who, through their officials, have permitted rate increases in almost all of the cities and towns served by companies under the management of H. M. Byllesby & Company. We believe that this fair attitude on the part of the public is due to the policy of our companies in the past in steadily reducing rates whenever the cost of production would permit. As a result of rate increases now in effect the earnings of our companies are being maintained and we are able to give 100 per cent service. How long it will be necessary to charge the higher rates depends, of course, upon operating costs. It is our intention, however, to reduce them to a pre-war basis as rapidly as possible."

American Light & Traction Operating Results.—In a statement to stockholders President Alanson P. Lathrop of the American Light & Traction Company said in regard to operations in the period ended Sept. 30: "The gross business of the subsidiary companies for the nine-month period has increased as follows: Gas sales, $1,008,954, or 10.24 per cent; electric sales, $222,528, or 12.32 per cent; traction receipts, $427,797, or 42.73 per cent. For the quarter ended Sept. 30, 1918, the decrease in net earnings over the corresponding quarter of 1917, based on the actual operating results, was $60,025, notwithstanding that during this quarter tax charges in the subsidiary companies were increased $90,000, while fuel and labor costs increased $234,600. The net earnings during the summer months have been reduced to a considerable extent by the daylight-saving law, which has been in effect since April. On the return to sun time on Oct. 27, 1918, losses from this cause will be largely eliminated."

Raise Rates or Operate on Part Time.—The Lompoc Light & Power Company, which supplies electricity to consumers in Lompoc, Los Angeles County, has filed with the California Railroad Commission an application for authority to either increase its rates for electricity or close its plant for use between 11 o'clock at night and the time lights are required the following evening. The application states that the high cost of oil, labor and materials makes the application necessary.

Safety in Lighting.—The National Safety Council, in "Safe Practices," on preventing accident hazards and practices for their elimination, says in referring to lighting: "Adequate light will materially reduce the number of accidents occurring in yards and buildings. Many industrial plants find it necessary to operate night gangs, and for this reason the proper lighting of the yard should not be overlooked. As a rule yards are less likely to be properly lighted than are other departments, and, as a result, many serious or fatal accidents have occurred."

Lightless Night Order Suspended in Massachusetts and Connecticut.—Fuel Administrator Storrow of Massachusetts has issued an order suspending until further notice operation of the "lightless night" order which has restricted the use of display and ornamental lighting on Monday to Thursday evenings weekly. Mr. Storrow declared that the soft-coal situation in Massachusetts is at present satisfactory, and that a reasonable use of electrical energy for ordinary lighting purposes should now be permitted. "Where a saving of light may be made, however, without inconvenience or hardship," the order states, "we believe that the people of Massachusetts will voluntarily curtail to that extent such energy consumption and thereby save coal that might otherwise be wasted." A similar suspension has taken effect in Connecticut.

Old-Type Instrument Wanted for the National Museum.—Charles Wirt, president Wirt Company, Armat Street, Germantown, Philadelphia, writes to the ELECTRICAL WORLD: "The United States National Museum has a valuable collection of early electric lighting apparatus which is being added to as gifts can be secured. I should like very much to secure for this collection a specimen of the early lamp indicator (engine-room voltmeter). This type was built by the New York Edison Works, also known as Bergman & Company, Seventeenth Street and Avenue B, and appeared about 1883 or 1884. This was a large-sized instrument of wooden-box construction built to stand upon a shelf with leveling screws and pointer swinging horizontally. This instrument in principle was a Wheatstone bridge, having two carbon lamps and two metallic resistances, comprising the four arms of the bridge. It was a very sensitive instrument and had the bad fault of varying with the variation in the lamps, as these were very far from being stable in continued use. If any of your readers know of the existence of one of these old type instruments, it would be well placed in the National Museum, where it would form part of a comprehensive collection."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Jurisdiction of Courts.—Matters within jurisdiction of the Public Service Commission must first be determined by the commission before the courts will take jurisdiction of any phase of the controversy, the Supreme Court of Pennsylvania held in Klein-Logan Company versus Duquesne Light Company (104 A. 763). A bill in equity to enjoin the electric company from terminating a renewal contract requiring the furnishing of electricity at certain rates was properly dismissed on the ground that the question was for the Public Service Commission in the first instance, in view of the public service law of 1913.

Proper Height of Lines Through Highway.—Companies engaged in transmitting electrical energy along the public highway must exercise such care as a careful and prudent person, having in view the dangers to be avoided and likelihood of injury, would exercise under the circumstances in placing their wires so as not to interfere with traffic, the Supreme Court of California held in Fairbairn versus American River Electric Company (175 P. 637). An electric company carrying a high-tension wire strung over a public highway must place it high enough to allow the passage of haystacking derricks underneath, where such derricks are properly and frequently moved over the highways in the district. That telephone and high power wires are strung along highways at a less height than those of an electric company does not constitute protection to such company in the case of injury occurring by coming in contact with its wires. Where a person was injured by receiving a high-power electric current through a hay-stacking derrick, brought into close proximity to electric wires from which the current arced to the derrick, the question of contributory negligence was for the jury. It was not error to modify instruction that defendant had a right to maintain a pole line along a road by adding to it that this was true if it exercised a high degree of care.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

A. W. Pipa has been appointed new-business manager of the Newburyport (Mass.) Gas & Electric Company.

A. S. Burdette has resigned as manager of the Greer (S. C.) office of the Southern Public Utilities Company to enter the army.

W. F. Bellinger has been appointed assistant superintendent of operation of the Georgia Railway & Power Company, Atlanta, Ga.

C. N. Rothrock has succeeded A. S. Burdette as manager of the Greer (S. C.) office of the Southern Public Utilities Company.

Burton T. Moury, a local electrical contractor, has been appointed acting manager of the Taunton (Mass.) municipal lighting plant.

John J. Chisholen, formerly superintendent of power of the New Orleans (La.) Railway & Light Company, is now superintendent of power for the Woodward (Ala.) Iron Company.

J. K. Sicellings has resigned as local manager of the Iowa Light, Heat & Power Company in the Remsen and Le Mars district to enter the steam-engineering school of the United States Navy.

W. M. Hammond, who was formerly assistant chief accountant of the State Public Utilities Commission of Illinois, is now acting chief accountant and statistician, replacing M. J. Murphy, who has recently resigned.

A. C. Babson, formerly manager of the Watertown and Watertown Extension divisions of the Wisconsin Gas & Electric Company, has been appointed assistant general manager of the company, with residence at Kenosha, Wis.

F. C. Jeannot has resigned from the Dayton Power & Light Company, for which he was the Wilmington district superintendent, to become superintendent at Sharon, Pa., for the Mahoning & Shenango Railway & Light Company.

W. H. Hartman, formerly foreman of construction with the Duquesne Light Company, Pittsburgh, Pa., has been appointed general foreman of the substations division. Mr. Hartman is a graduate of the Carnegie Institute of Technology in electrical engineering, class of 1912.

John S. Everett, formerly accountant of the Central Maine Power Company, with headquarters at Augusta, will shortly proceed to France to audit the accounts of the Fifth and Sixth Marine regiments — the commands which stopped the German advance at Château Thierry. Mr. Everett recently enlisted in the Marine Corps.

L. B. Faulkner, manager of the Olympia (Wash.) Light & Power Company, has been elected president of the company to fill the vacancy caused by the death in October of General Hazard Stevens, who had held that position since the reorganization of the company in 1900. Mr. Faulkner has been manager, treasurer and trustee of the company since its organization and has taken an active part in the formation of the Northwest Electric Light & Power Association, of which he is now president. Since the organization of that association he has been a member of the executive committee.

George M. Keenan, has resigned from the Little Rock (Ark.) Railway & Electric Company to become connected with the Lehigh Navigation Electric Company, Allentown, Pa. Mr. Keenan went to Little Rock last spring as superintendent of the railway power plant.

John A. Fritz has resigned from the Scranton (Pa.) Electric Company, of which he was chief engineer, to become associated with the Penn Steel Company, Chester, Pa. Mr. Fritz had been with the Scranton company in the capacity of chief engineer since Feb. 1, 1910.

C. D. Carlson, chairman of the power and heating section of the new-business coöperations committee of the Ohio Electric Light Association, has resigned from the Cleveland (Ohio) Electric Illuminating Company to become associated with the Otis Steel Company of Cleveland.

William J. Reagan, who has been connected for a number of years with the sales department of the Utica (N. Y.) Gas & Electric Company, has been appointed commercial manager of the company in charge of both lighting and power departments. Mr. Reagan will also direct the appliance sales.

R. A. Philip, who will be consultant on electrical engineering matters, reports, estimates and appraisals of electric utility and power properties in the new consulting-engineer firm of Dwight P. Robinson & Company, Inc., was born in 1874. He is a graduate of the Rose Polytechnic Institute. His early experience was as assistant to the city electrician, Tacoma, Wash., and with the General Electric Company. Later he was electrical engineer of the Seattle (Wash.) Electric Company, where in 1900 his association with Mr. Robinson began. This has continued ever since.

C. W. E. Clarke, for seven years with Stone & Webster, five of them as mechanical engineer and head of the division, has become associated with Dwight P. Robinson in consulting engineering work in New York in Dwight P. Robinson & Company, Inc. Mr. Clarke has had a long and varied experience in the design of central power stations and mechanical engineering industrial plants. Some of his earlier work was as steam engineer of the electric zone, New York Central Railroad; designing engineer, Armour & Company, Chicago, and assistant to the chief engineer, Sargent & Lundy, Chicago. He has been intimately connected with or responsible for such stations as the new steam plant of the Buffalo General Electric Company, the South Boston plant of the Boston Elevated Railway, the new plant of the New Bedford Gas & Edison Light Company, the Lowellville plant of the Republic Railway & Light Company, the Fisk Street plant of the Commonwealth Edison Company, Chicago, the Yonkers plant of the electric zone, New York Central Railroad, and more than thirty others of various capacities, totaling many hundred thousand kilowatts.

Dwight P. Robinson, a former partner of Stone & Webster, in charge of their construction and engineering business, has opened offices in New York under the name of Dwight P. Robinson & Company, Inc., constructing and consulting engineers. Mr. Robinson's work runs back for a period of twenty-five years, during which he has been associated with Stone & Webster, first in the management of some of their electric railway and lighting properties, later, for fifteen years, as president of the construction and engineering branch of the organization. Since 1912 he has been a member of the firm. Some of the more generally known projects which came under his personal supervision were the extensive water-power developments serving the Puget Sound cities, the steam and water-power plants supplying Minneapolis, the electrical and transmission features of the Keokuk development on the Mississippi, the Big Creek development serving Los Angeles, large steam-power stations for Buffalo, Boston, Minneapolis, New Bedford, Youngstown and other smaller plants, aggregating over 500,000 kw. capacity, in addition to the new home of the Massachusetts Institute of Technology. Mr. Robinson is a graduate of Harvard University and the Massachusetts Institute of Technology.

Obituary

Edward P. Putnam of Waterville, Me., formerly employed in the engineering department of the Central Maine Power Company, died recently in army service at Charleston, S. C.

Henry E. Randall, Jr., general manager of the Ludlum Electric Furnace Corporation, died at Montreal, Canada, on Oct. 21 from influenza. Mr. Randall was graduated from the Massachusetts Institute of Technology in 1913 and was employed by the Shawinigan Water & Power Company, first on the Cedars Rapids development and later in the company's offices in Montreal. Before severing his connection with this company on Oct. 1 last to take up the work which he was doing at the time of his death he was power sales engineer for the Shawinigan company and manager of the subsidiary electrical companies.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

CREDIT MEN GIVE THE OUTLOOK ON BUSINESS

Situation Viewed in Retrospect and Prospect Shows Optimistic Feeling—Large Reduction in Number of Delinquent Accounts

A general summary of the activities of the Electrical Credit Association of Chicago in the past year, as expressed at the annual convention on Nov. 22, shows that the electrical business has been conducted on a more favorable basis during the past year than for many years previously. Reports made by members to the association, which really cover the entire Middle West, indicated that the number of delinquent accounts had decreased 23 per cent over the preceding year and that the amount of the delinquent accounts reported had decreased 3.6 per cent. The wide difference in the two percentages was attributed to the fact that a large number of slow-pay electrical contractors have gone out of business during the stringent war period in which building has been so seriously curtailed.

A report from the Pacific Coast indicated the belief in that section that the worst is now over for the jobber as far as the Pacific Coast credit problem is concerned. It is believed there that building will open up which will supply work for the contractor-dealer and give him an opportunity to meet any obligations he may incur.

The delegation from Cleveland expressed the belief that the government was acting in an entirely fair manner in the cancellation of all contracts. Collections in that district were at present characterized as good, although they had been somewhat "sticky" as late as a month ago. The outlook for the Cleveland territory was painted in especially brilliant colors owing to the belief that shipbuilding as well as industrial work will sustain the commerce and industry of the city. No difficulty is anticipated in absorbing the 50,000 men who will be returned to Cleveland through demobilization. While the opinion was expressed that utility business will pick up, no radical change in building conditions was expected immediately. It was thought that the credit man in that district must closely watch the electrical contractor lest he become over-zealous and incur too great obligations.

From Detroit came the viewpoint that credit conditions will change more rapidly during the reconstruction period than they changed even during the war period, when things were moving with exceedingly high speed. Detroit is well pleased with the business of the past year and expects good business in the future. The stock shelves of the world are bare. Orders may not be so large, but they will be numerous. This will necessitate close watching of credits and will make all ledger experience of great value. Detroit is much behind with its building, as is the entire State of Michigan. The opinion was expressed that credits in Detroit have been enhanced through the elimination of the sale of liquor.

Minneapolis delegates expressed nothing but enthusiasm over the big year which is seen ahead. At Columbus, Ohio, 98 per cent of the houses which are now built are occupied at good rentals. A building boom is expected there.

Frederick Vose of Chicago, secretary of the association and also of the national association, stated that after talking with men in many lines of industry, he felt there was no need for fear concerning business during the reconstruction period. He expressed the belief that business would go at full speed ahead for at least five years. The iron and steel industry is very confident, financial problems are well in hand, foreign financing is necessary, building will boom, foodstuffs and clothing will be needed, and the railroads will continue to be prosperous. The greatest danger lies in over-confidence.

CONDITIONS UNDERLYING NEW CONSTRUCTION WORK

It Will Be Some Months Before Electrical Material Is Used Extensively—Non-Investment Projects Will Probably Go Up First

Ever since the armistice was signed, and in fact since long before that, there has been considerable comment regarding the vast amount of new construction that cessation of hostilities would bring. To the electrical manufacturer and jobber new construction and expansion means added business. A careful investigation then of the influencing factors should be helpful. Jobbers will lay in stock on the basis of what they judge conditions will be. Manufacturers will purchase raw materials on the same basis. If these purchases are made without a comprehensive idea of conditions, it is easily conceivable, especially if the market is delayed, that losses will arise which may be met only with great difficulty.

Taking the general building situation first, it is reported, and probably correctly, that architects are all once more becoming busy and that there are large numbers of new projects under consideration. The sums involved run into quite large figures. However, the fact must not be lost sight of that building operations as a rule do not start in the winter. In fact, if the much-talked-of building boom does come, it is doubtful if actual operations will commence much before the first of March. On that basis it would be the first of May or later before builders would be ready for electrical equipment.

Furthermore, it is not every type of building that will be represented equally in this boom. It seems pretty definite that structures put up to rent for many years must wait for lower prices of labor, money and materials if a return on the investment is to be made from future rentals. Low-priced apartment houses on speculative land might be erected with the idea that excessive rentals for a year or two would absorb excessive construction costs. Office buildings, however, have not this advantage.

Buildings and construction work not expected to pay a return on investment apparently offer the best construction market. These include churches, schools and other municipal buildings, government and state buildings, street-lighting systems and private dwellings.

In other words, in spite of the dearth of new construction for some time, it hardly seems possible that investors are going to enter the market without its being apparent that the building will pay its way in the future. It seems logical to suppose therefore that to stimulate investment building lower prices must come for materials, labor and money. Some materials are already a bit lower as the tendency of producers is to stiffen the market.

Money is perhaps more of a controlling factor than the other two. It is high at present, and more Liberty loans are expected next year and there are federal taxes to pay in the spring. However, it is not inconceivable that the banks will come to the rescue of new building with cheaper money if this course should be found necessary to protect other great credits.

FAN-MOTOR MARKET IS STIMULATED BY ARMISTICE

Since the Restrictions on Manufacture Have Been Reduced, Makers of Appliances Are Ordering Motors in Large Quantities

There has been one market certainly that has benefited immediately from the signing of the armistice. That is the fractional-horsepower motor market. Earlier in the year the War Industries Board found it necessary to require a curtailment of output of virtually all of the small-motor-drive appliances other than tools. At that time manufacturers of these appliances were finding it difficult to satisfy the demand. Later when the restriction went into effect it, of course, meant a rationing of the market.

Shortly after the armistice was signed, however, the restrictions were cut in half, and at once appliance manufacturers began to besiege motor producers for small motors. A number of appliance manufacturers are bending every effort to get satisfactory stocks in local warehouses for the holiday trade. As a result the fractional-horsepower motor market has been receiving during the past ten days a very large volume of new business.

METAL MARKET SITUATION

Market Continues Dull—War Board Fixes Pig-Tin Prices—Good Demand for Spelter

The War Industries Board has authorized the United States Steel Products Company, the distributing agency for tin in this country, to sell pig tin in lots of not less than 25 gross tons at 71¼ cents a pound, Pacific Coast ports, and at 72½ cents at New York and Chicago to consumers, dealers and jobbers. These prices are to rule for December and January. Dealers can resell in lots of 5 gross tons or more to consumers or jobbers holding purchase licenses at a profit not to exceed 2½ per cent.

New business in copper is still at a standstill, and nothing in that direction is expected this month until some indication or news is received as to what the action of the copper producers, acting in unison with the wishes of the authorities at Washington, is to be regarding prices after Jan. 1. Many who were inclined to the belief that copper prices would be held unchanged until enough time had elapsed to develop the large expected peace demand are now inclined to moderate their views on price changes. The attitude of labor is the point that stands out most clearly, and a wage readjustment must come if labor wishes to work full time.

The slight hesitancy in the spelter market the past few days has been overcome by renewal of inquiries and orders from the galvanized trade, and to-day the demand is as good as at any time lately, with sellers again holding off.

NEW YORK METAL MARKET PRICES

	Nov. 25	Dec. 3
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	28.75	28.75
Lead, trust price	8.05	7.05
Antimony	8.75	8.62½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	8.70 to 8.80	8.75
Tin	71.00	72.50 (official)
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21.00 to 21.50	21.00 to 21.50
Brass, heavy	11.50 to 12.00	11.50 to 12.00
Brass, light	9.00 to 9.50	9.00 to 9.25
Lead, heavy	6.00 to 6.50	5.75 to 6.00
Zinc, old scrap	5.75 to 6.00	5.75 to 6.00

THE WEEK
IN TRADE

A TEMPORARY depression still rests on the market. Manufacturers are making plans to take care of greatly increased commercial business and almost every one is optimistic over the outlook.

Christmas business, which was not expected to be very large this year, is now being looked forward to eagerly by retailers. Already some very good reports on this account are coming in.

Jobbers' stocks are much better this week than last everywhere. There are still a few spotted conditions, but, generally speaking, stocks are sufficient to meet all reasonable demands. Jobbers are buying much closer to demand than they did last month, and indications are that a more rapid turnover basis will be followed.

The meeting at Atlantic City this week is expected to help industry generally in its reconstruction problem. The transition from a war to a peace basis is full of uncertainties. Labor is very quiet just at present and still scarce, although becoming more plentiful.

NEW YORK

The market this week in most lines has been quiet, and buyers show a tendency to hold back for lower prices. Supplies on hand are getting lower and jobbers do not show a tendency to stock up at this time.

Practically everything in the electric appliance line, however, shows increased demand, with short stocks on hand. Better deliveries of vacuum cleaners can be expected before Christmas, but more or less on a pro rata basis. Demand for all heating appliances has taken a big jump the past week, and the market is short of stocks. Brisk sales of fractional motors are also reported and one dealer stated that small-motor business was never better.

Shortage of labor is still a factor but should improve soon.

MOTORS.—Cancellations for motors of the larger type have taken place in considerable volume, and demand the past week has fallen off noticeably. Fractional motors, on the other hand, show a very marked increase in demand, and sales the past few days have been very brisk. The growing popularity of the washing machine has greatly stimulated sales of small motors. Supplies on hand are good and shipments prompt.

VARNISHED CAMBRIC.—Prices remain stationary, and supplies on hand are in better volume owing to the release of large amounts of cotton cloth which was to be used by the Red Cross. Export demand, particularly for Japan, is increasing and deliveries are good.

MICA.—Supplies on hand are good and show a tendency to increase owing to South American imports. Prices are softening.

LAMPS.—Following the removal of the lighting restrictions by the Fuel Administration the lamp market is showing increased demand. Supplies on hand are adequate.

LAMP CORD.—Demand is very firm, and supplies on hand are limited. As the holiday season approaches large sales of portable lamps are expected which may be considerably curtailed if the necessary lamp cord cannot be obtained.

RADIATORS.—Cold weather has at last set in, and the demand for electric radiators is insistent. The market is practically bare of supplies, with no immediate hope of much betterment. As an example of the situation one distributer has sold during the past year 9000 radiators and expressed the opinion that he could have disposed of 20,000 had he been able to obtain them. It is also reported that

a manufacturer of a well-known brand has unfilled orders on his books for 70,000 radiators.

HEATER CORD.—It is practically impossible to get any quantity of heater cord in the market to-day. Supplies on hand are most limited and deliveries for the near future doubtful. One well-known supplier voiced the opinion that he did not think the market for heater cord would be back in its normal condition for ten months, the underlying reason being the great shortage of rubber and asbestos yarns.

CHICAGO

The general business situation in the Middle West can best be summed up in the two words "watchful waiting." There is plenty of evidence that business is all ready to go ahead in many different directions, but there seems to be some hesitancy on the part of controlling factors here and there in actually getting into action. There are a number of contributing causes. Business men appear to be awaiting the outcome of the meeting of the United States Chamber of Commerce at Atlantic City on Dec. 4, 5 and 6. A definite solution of the government contract situation will also assist in clearing up the outlook. Removing all restrictions from business in essential material has assisted to some extent, but the demand thus created is not so great that it cannot be easily supplied. The holiday outlook for electrical devices at the present moment does not seem to be especially bright. Jobbers report that small dealers are buying from hand to mouth to supply the early Christmas trade and have given no indication of making an intensive effort to go after business. Jobbers are of the opinion that their business for December will be of somewhat meager volume; nevertheless, the whole year of 1918 as compared with 1917 will be entirely satisfactory.

The falling off of central-station loads is now beginning to be apparent in some centers. It is altogether probable that many central stations which have large industrial power loads will find that they passed their peak on or about Nov. 30. This is a rather peculiar circumstance, as the peak loads of these stations usually came a few days just before Christmas. The entire load curve of such central stations for the fall months has been different from what it is in normal years on account of the shift in the clocks and the signing of the armistice. Central stations which were normally producing about 15 per cent more energy than they had turned out last year found that just before the clocks were shifted their load was less than it had been on the same days of the previous year. Immediately the clocks were shifted, however, the peak loads began to mount higher and higher, attaining a maximum on or about Nov. 30. Following the signing of the armistice there has been a drop that ranges from 10 to 15 per cent in the peak load. It is expected that there will be a still further decline, but this has not presented an annoying situation, for central-station men believe that in February and March they will pick up all of the loads they formerly had and probably some other additional business held back by the war.

The building situation continues promising, particularly in connection with municipal improvements.

WIRE.—The market on small sizes of wire appears to be easing up gradually, it being possible for some, not all, manufacturers to supply their distributers with No. 12 and No. 14. It is the belief that this situation will gradually improve.

CONDUIT.—Jobbers are now shipping to all classes of trade without asking any questions. It is the belief that, in spite of the contracts for the navy which are holding up the producers to some extent, conduit will be back on a normal basis within about one month.

ELECTRIC HEATERS.—There is still a shortage of electric heaters. Complaints are heard in the trade that the manufacturers of these devices are driving business away by retaining in effect their ruling that all orders are placed subject to the price in effect on the date of shipment. Such an arrangement was all right under abnormal conditions, but the manufacturers now can contract for material, and the distributers feel therefore that the ruling should be annulled.

INCANDESCENT LAMPS.—Jobbers' stocks are reported to be in excellent shape.

ELECTRIC TOOLS.—One manufacturer is getting ready to announce a full line of electric tools such as portable drills and grinders which he intends to market through the electrical trade.

FUSES.—It is reported that there is some falling off in demand.

INSULATING VARNISHES.—Three concerns have recently signified their intention of going after this class of business more intensively in the electrical field.

WASHING MACHINES.—Manufacturers report that the demand for washing machines is expected to remain at high level for at least one to one and a half years, and at present prices, since producers during that period will have small chance of reducing their costs.

BOSTON

Business continues exceedingly brisk, despite progress in cancellation of war orders, which tends to slow down industrial activity for the time being. Manufacturers are devoting close attention to readjustment questions, and so far little has been heard as to labor disturbance. Well-informed opinion, however, urges caution in the rate of cancellations, holding that even at the cost of some waste of raw material and labor it is better to allow plenty of time for the transition from war to a peace basis. Jobbers report substantial stocks in most lines, and at present the larger houses are buying comparatively little material, preferring to dispose of present accumulations instead of going into the market actively for new supplies. Deliveries are improving a little. Collections are in reasonably good shape and show no material change over last week. Prices hold firm, and it is rumored that some appliances will be still higher later on. Central-station sales departments are beginning to receive holiday trade, and the opinion is expressed that unless manufacturing interests attempt to profiteer by raising prices without adequate grounds a fine winter's business will be enjoyed.

CONDUIT.—The larger houses are in better shape to meet new business demands than for some time. The removal of restrictions by the government means a better flow of pipe into New England, and jobbers who have ordered far ahead are now reaping the reward of their foresight. Stocks are still spotty, and a large movement of conduit is expected later.

ELECTRIC RANGES.—Stocks are fair and expansion of business is anticipated after Jan. 1. Central stations have many prospects on their books. Sales are still held back by the lack of labor, material and money for line extensions.

MOTORS.—The demand appears to be slackening somewhat, and many cancellations are being received. Stocks are gradually increasing, though now and then a particular size and speed cannot be secured. Up to 50 hp. rating, the supply of motors is now fairly large. There are many motors likely to be turned over to the second-hand market as war contract work dies down.

TRANSFORMERS.—Deliveries are improving. A large supply is expected by the second-hand market.

MOLDED INSULATION.—Some reduction in the volume of business is noted. The producers are looking toward the domestic market to absorb the future output. Price tendencies are still upward, but may not go much higher.

CHRISTMAS-TREE OUTFITS.—Stocks are fairly well in hand now to meet the trade of the holidays. The retail demand has begun for these equipments.

PORTABLE LAMPS.—An increasing demand is noted, and the price situation is not expected to have much effect on the holiday trade. Electrical gifts are likely to be in great demand this year, and while the lower and medium-priced portables are in greatest demand so far, a good trade is looked for in all grades.

SMALL STEAM TURBINES.—Makers of these units for auxiliary service will be busy for some time. The naval program of the country accounts for a large percentage of orders, and while the central stations are not as yet making inquiries, a loosening up of expansion restrictions may be expected before long. This is likely to mean a little more commercial business for the turbine makers, especially in connection with betterment work in plants. There is not much prospect now of any real boom in the electrical utility market for turbine sets of small size, however.

ATLANTA

A rough survey of the electrical field indicates that buyers are becoming more cautious while awaiting the results of readjustment in the near future. A large volume of business has been recorded during the last eighteen months on a rising market, and it is only natural that jobbers should exercise proper care when they anticipate a sagging market, even if a material decline is recorded over a comparatively long period.

Stocks are in almost normal condition, or in quantities to cover sixty-day turnover periods. As the quantity of stocks has varied so much in the last two years, there is really no other way to compare stocks than on the turnover basis. The tendency is to clean out present stocks of heating appliances before the first of the year and gradually build up stocks in the early part of 1919. On the whole, business is excellent and the much-talked-of slump in sales has not materialized up to this writing. All sources report deliveries as improving.

INCANDESCENT LAMPS.—The usual December demand for lamps of all types is now in full swing, and the volume of business is well up to that recorded during the same period a year ago when government requirements for cantonments were especially heavy. Stocks are well distributed throughout the Southeast, and jobbers are supplying the trade with little difficulty. For six to eight months past the insistent and steady call for government account kept the stock of 75-watt and 100-watt lamps at a low level, but buying from this quarter has been steadily slowing up and stocks are being replenished.

FIXTURES.—Dealers report that business has been big up to this time. A large quantity of this class of goods has been shipped to the smaller towns for distribution to rural points where numbers of farm-lighting outfits have been installed. Although this type of consumer has prospered during the war, the greater portion of sales was for the moderate-priced three-shower and four-shower fixtures. This market in itself has helped to fill in the valley caused by the slump in general building. On the other hand, the completion of buildings has tended to help out the situation, but as it will take some time for the new work to reach the point where the fixture demand will again become normal, many dealers will push the farm-lighting fixture business to the limit and get rid of their present stocks, anticipating a decline in metals.

PORTABLES.—A substantial business is being transacted in these and especially in the higher-priced lamps. One large dealer reports that he expects to sell out his entire stock during the holidays, but he is not going to order replacements extensively at this time. Individual shades are popular and moving faster as the holidays approach. Prices covering the entire line are steady.

SEATTLE—PORTLAND

The recent slump in price of copper is causing considerable alarm among Northwest jobbers, those in Seattle particularly, where stocks of wire of some proportions are held owing to heavy demand for this commodity from shipbuilding sources and the inability to secure satisfactory deliveries. Several of the larger firms were carrying stocks in excess of requirements. Another thing which is causing worry, to jobbing houses especially, is the threatened strike of the labor unions protesting against the Mooney decision and the strike of shipyard workers on the Pacific Coast because of the Macey board award. Electrical business undoubtedly will be hard hit if the strike set for Dec. 9 materializes as the larger portion of electrical jobbing business is with shipyards and allied industrials.

Jobbers as a whole in Seattle report business during the past week exceptionally good in spite of the Thanksgiving holiday. Sales are well sustained to industrials, and retailers report quickened movement along domestic-appliance lines with indications that Christmas trade will be far better than originally predicted. Jobbers have fair stocks of electric household lines, and small dealers are making purchases. The Morrison Mill Company, Bellingham, Wash., is making arrangements to install new electrical equipment, including a large dynamo and thirteen motors, etc. Portland electrical contractors report the usual amount of business for the past week. Some have more than they can handle. This condition, however, does not extend to the supply houses. Electrical manufacturers' representatives report business very slow during the past week, with very few sales of generators, motors and like equipment. Buyers are apparently holding off until conditions are more settled. From present indications there should be ample stocks of motors and transformers on hand for some time to come. The very unexpected order of the government canceling all wooden-ship contracts, twenty-nine in all, valued at approximately $20,000,000, except in cases where ships are actually under construction, created a decided feeling of depression in business circles and has caused a decidediy conservative attitude to be taken by all who are contemplating any extension of new work at this time. Sudden and drastic cancellation of government contracts for woolens in the Portland district placed this industry also in serious condition temporarily. Contracts calling for the construction of 2000 railroad cars are held up, and the largest car-manufacturing plant of the Northwest has been idle for a week as the result of a strike at the plant of the Pacific Car & Foundry Company. The Foundation Shipbuilding Company, Tacoma, is seriously considering converting its large wooden plant into a steel yard equipped with eight ways. The present plant covers fifty-five acres and has ten ways.

SAN FRANCISCO

The prospect of the immediate return of troops, particularly the drafted men taken last, is making a difference in the labor situation in California, and material improvement in general conditions is expected to result. Plans of reconstruction for returned wounded soldiers are claiming popular attention, and indications are that California will enjoy a good share of activity in that line. The lifting of the ban on development work is being felt first in extensions and additions which power companies and other public utilities have deferred for some time. The development of more water power in California is regarded as a certainty as soon as there has been time to study the situation in the light of the peace basis and to arrange the financing. The influenza epidemic is past in San Francisco. Public gatherings, etc., were resumed Nov. 16. Business had entirely regained its normal level by the last week in November. Los Angeles, on the other hand, had a longer siege, and December business was still depressed.

Orders for electrical equipment and material in the central valleys of California have been increasing, particularly for next year's irrigation work with orders for pumping installations up to 200 hp. or 300 hp. Freight shipments between Eastern factories and San Francisco are now averaging about twenty-eight days, no noticeable effect of peace conditions having yet become manifest on transcontinental freight.

Transformer stocks are in excellent shape now, and orders for practically all sizes can be filled immediately. Small motors are being ordered on a three to four month basis now instead of the eight to twelve month basis necessary until recently. This condition relieves the necessity for carrying large stocks on the Pacific Coast, and orders to the factories are being adjusted accordingly. Effort is being made to return promptly to a stock condition such as will balance the difference between demand and present delivery rates.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+30% to $73.20
Coil to 1000 ft	List
	No. 12 Solid
Less than coil	+30% to $85.20
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00
	No. 12 Solid
Less than coil	+20% to $162.00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
2 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40 to $0.45	$0.40 to $0.45
12 to 50	.35 to .39	.35 to .39
50 to barrel	.319 to .362	.329 to .382
Barrel lots	.289 to .332	.299 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
⅞	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
½-in. single strip	$75.00	$63.75— 69.75
½-in. double strip	75.00— 82.50	72.00— 75.00
¾-in. single strip	100.00	85.00— 93.00
¾-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
½-in. single strip	$75.00	$63.25 to $63.75
½-in. double strip	78.25 to $90.00	71.25 to 75.00
¾-in. single strip	100.00	75.00 to 85.00
¾-in. double strip	105.00 to 120.00	93.00 to 100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
½	$0.05½	1	$0.25
⅝	.06	1¼	.33
¾	.09	1½	.40
⅞	.12	1¾	.47
	.15	2	.55
	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
½-in.—	$25.00–51.70	$24.60–35.20	$23.00–30.25
¾-in.—	30.00–56.40	28.00–38.40	26.00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
½-in.—	$44.00–60.00	$30.00–33.00	$26.50–29.15
¾-in.—	48.00–65.00	33.50–36.00	29.00–31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	⅛ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7.1%	9% to 9.1%
2500 to 5000 lb.	10% to 10.1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	⅛ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to 3.5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +0.5%	+5% to 1.5%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00 to $7.00
Discount	20% to 30%

CHICAGO

List price	$6.00 to $7.00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $9.37
1/5 to std. pkg.	5.25 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$8.00
1/5 to std. pkg.	7.00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.6[illegible]
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.47—$40.77
Coil to 1000 ft	27.42— 30.22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38.00
Coil to 1000 ft	28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$23.93 to $30.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $34.00
1/5 to std. pkg	17.85 to 28.90

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$21.00–24.15
1/5 to std. pkg	17.85–21.00

Standard package, 2200. List per 1000, $20.00–21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$16.00 to $22.00	$32.00
1/5 to std. pkg	13.60 to 18.70	27.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$13.00–$18.40	$32.00–$36.80
1/5 to std. pkg	11.50– 16.00	27.20– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 to std. pkg	10% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 30%	Net
$2.00 to $10.00 list	10% to 35%	5%
$10.00 to $50.00 list	20% to 37%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to 6.50
Discount	20% to 30%

CHICAGO

List price	$6.00 to $7.00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.54–$0.66
No. 18, full spools	.52– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.71
No. 18, full spools	.55 to .595

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00–$25.00	$15.00–$17.00	$15.00–$15.75
12	23.58– 27.09	21.62– 29.09	17.68– 23.22
10	30.20– 37.80	27.45– 32.40	23.47– 32.40
8	42.74– 53.34	38.85– 45.72	33.21– 45.72
6	61.50– 84.42	55.35– 72.36	52.58– 55.48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25.00	$18.00–$25.00	$15.50
12	$29.46– 31.44	29.46– 31.44	$25.54– 31.44
10	41.10– 43.84	41.10– 43.84	34.62– 38.36
8	57.00– 61.76	57.00– 61.76	50.18– 54.04
6	85.31– 97.68	85.31– 85.47	77.21– 85.47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39.75 to $44.00
25 to 50 lb	39.75 to 42.00
50 to 100 lb	38.75 to 40.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$41.00 to $41.76
25 to 50 lb	39.75 to 40.76
50 to 100 lb	38.75 to 39.76

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Trackless Trailer with Dump-Car Body

With the increasing use of industrial electric tractors has come the need of trailers for specialized service. With this in mind the Easton Car & Construction Company, Easton, Pa., is manufacturing a trackless trailer mounting a dump body to speed up the loading and unloading of loose materials such as coal, ashes, sand, ore and slag.

Four extra large wheels furnished with roller bearings and either rubber or composition tires assist the trailer in running smoothly over all types of flooring and even quite rough ground. Close tracking in trains of these cars

DUMPS LOAD AT ANGLE OF 45 DEG.

is said to be accomplished with comparative ease since both front and rear tracks of the trailers are fitted with swivels.

Among the important features claimed for the car body are a special latch for locking it in a half-dumped position, thus giving a low height for hand loading; heavy construction of the body, which dumps clear of the wheel at an angle of 45 deg.; cast-steel wheels, sturdy underframes and automatic safety latches.

One-Piece Porcelain Refillable Fuse Plug

A simply constructed 125-volt service refillable fuse plug for 3-30 amp. is the latest product of A. F. Daum, 1157 Hodgkiss Street, Pittsburgh, Pa. The body of the plug is a single piece of porcelain with threads for socket insertion and slits through which the metal fuse strip is passed. A transparent mica cover completes the plug.

Simplicity in renewing the fuse strip is a feature claimed by the maker, the operation consisting of passing ends of the new strip up through the two bottom slits in the porcelain and bending one end down into a groove cut in

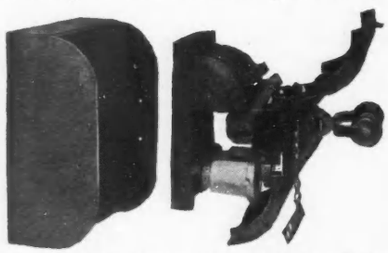
THE ONLY METAL PART OF THIS FUSE PLUG IS THE FUSE STRIP

the threads. Securing this end in a small opening at the bottom of the threads and replacing the mica cap completes the renewing.

Motor-Starting Switch with Overload Protective Plugs

Besides the quick-make-and-break mechanism of the CR-1038 switch manufactured by the General Electric Company of Schenectady, N. Y., the feature of time overload protective plugs is pointed out. Designed for connecting alternating-current motors up to 3 hp., 110 volts, and 5 hp., 220, 440 and 550 volts, direct on the line, these switches have protective plugs inserted below the switch proper and inside the sheet-iron case covering the entire device.

The plugs consist of a stationary contact post with a heating coil and



SWITCH MOVEMENT REMOVED FROM CASE, SHOWING PROTECTIVE PLUGS

a fusible link which binds a spring contact to the stationary post. The motor circuit is completed through the heating coil, post, fusible link and spring contact arm, so that in case of an overload the current passing through the coil will heat the post sufficiently to melt the fusible link. This releases the contact arm, which springs out of touch with the stationary post and breaks the circuit. The manufacturers state that the links are both inexpensive and easily renewed.

By reason of the time-lag feature the momentary increase of starting current is said not to cause the plug to open the circuit, only acting to protect the motor when overload conditions are maintained for periods long enough to overheat the motor. Under these conditions the plugs open the circuit in time to prevent the motor carrying too heavy a load from attempts to start stalled motors and multiphase motors running single-phase.

Non-Water-Tight Push and Pull Switches

Side or rear entrance styles may be secured in the non-water-tight push and pull switches for marine service,

SUBSTANTIAL MARINE SWITCH

rated at 5 amp., 125 volts, and are being marketed by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago. The mechanism is said to be heavy and sturdy in construction with plunger control, and the connectors, of the binder screw type, are easily accessible. High-heat-molded insulating material composes the base. Tappings may be furnished for ½-in. (1.27-cm.) pipe connection one-way, and two of the models will be tapped ¾ in. (1.9 cm.) one-way, or ½-in. (1.27 cm.) or ¾ in. (1.9 cm.) two-way, if desired. The boxes for these switches are brass or iron while the cover is of brass threaded for connection to the box. Standard marine black finish is used.

Trade Notes

EXTENSION OF PERIOD OF VALIDITY OF IMPORT LICENSES.—In W. T. B. R. 315, issued Nov. 11, the War Trade Board announced that all import licenses would be valid to permit shipment of the commodities referred to therein within a period of ninety days from the date of the issuance of the license. The War Trade Board now announces that henceforth all import licenses which have been issued, or of which extensions have been issued, on or after Aug. 25, 1918, or which may hereafter be issued or extended, will be valid indefinitely unless revoked, provided that it is not otherwise expressly stated in the license. The provision printed on the import license forms which have been and are still in use, that the license is valid for ninety days only, will therefore be disregarded.

COURSE OF WAGES.—In drawing some analogies between the respective periods immediately following the civil war and the late world war, the Guaranty Trust Company of New York makes the following instructive remarks regarding the course of wages: Wages lagged very much behind prices in both the upward and the downward movements after 1860; they increased more than prices and sustained the gains for a longer time. Specifically, according to Professor Mitchell's tabulations, the high peak in prices came in January, 1865, and there was an almost uninterrupted decline thereafter, the index number for 1880 standing at only 4 per cent above the level for 1860. Wages, on the other hand, rose much more slowly during the war period, but continued to rise generally until July, 1872, seven years after prices had begun the long decline. The margin of gain for the workers, the net increase in real wages, maintained at the close of the twenty-year period, is roughly measured by the indices. They show a gross gain of 38 per cent in wages in 1880 over the 1860 level, against a net increase of 4 per cent in wholesale prices.

SHORTENING THE CONSERVATION LIST.—The changed situation arising out of the signing of the armistice makes it possible for the War Trade Board to alter many of its regulations governing the exportation of certain commodities which the continuance of the war has heretofore made it necessary to conserve much more strictly than present circumstances require. For the war needs of the United States and the Allies the War Trade Board has limited the exportation of many commodities which may now be spared for general export trade, as they are no longer needed for war purposes. In pursuance of this policy, the War Trade Board is now revising as rapidly as possible its rules of conservation, and in conformity with such revision the conservation list will be materially abbreviated. The War Trade Board is now in a position to grant many export licenses which heretofore have been refused for reasons of conservation. There are now, and for some time to come there will be, certain commodities the exportation of which must be carefully controlled because of the general world shortage, but even for the exportation of these commodities licenses will be granted as freely as possible. The issuance of licenses will be greatly facilitated if exporters will state on their applications whether the licenses are required for business which is actually in hand, subject to export license, together with the dates of their orders. In connection with the foregoing exporters should be advised that, while it is no longer necessary to conserve commodities for war purposes, it may become necessary to regulate the exportation of certain commodities essential to the rehabilitation of Europe and Siberia, and exporters should be further advised that it may become necessary to place restrictions upon the exportation of bulky commodities by reason of the scarcity of tonnage available. The return of troops, the carriage of supplies for troops not yet returned and the carriage of commodities required for the relief and reconstruction abroad make demands upon the world's tonnage of such magnitude that it is impossible as yet to determine when there will be an increase in the tonnage engaged in unregulated trade. Tonnage continues to be the controlling factor, and when reconstruction is well under way it may become necessary to subject certain raw materials to rationing. The War Trade Board also calls attention of exporters to the fact that the trading with the enemy act still remains in full force and effect.

THE H. W. JOHNS-MANVILLE COMPANY has purchased 255 acres as a factory site in Chicago. It is said to be the intention of the company to erect as soon as conditions will permit a duplicate of its large plant at Manville, N. J. It will cover 1,250,000 sq.ft. of floor space at a cost of approximately $3,000,000.

SIBLEY & PITMAN, electrical supplies, formerly located for six years at 19 West Thirty-sixth Street, New York, moved last month to very much larger quarters at the corner of Thirteenth Street and Sixth Avenue. Greatly increased business necessitated larger space, and the new store, sub-basement and cellar contain over 20,000 sq.ft.

BENJAMIN I. FULLER has resigned as superintendent of foundries of the Westinghouse Electric & Manufacturing Company to become vice-president and general manager of the following companies at Niagara Falls, N. Y.: Niagara Electric Furnace Company, Defiance Paper Company and Niagara Wall Paper Company. Mr. Fuller was connected with Westinghouse interests for twenty-eight years.

THE W. E. DAVIS ADVERTISING SERVICE, 1203-4 Plymouth Building, Minneapolis, Minn., will hereafter be known as Davis & Armstrong, Inc. This new arrangement includes the services of J. C. Armstrong as well as those of W. E. Davis. This firm is well known in the Northwest as one which gives special attention to technical advertising accounts, including that of the cedar pole associations.

I. H. MILLS, who has been associated with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., for the past twenty-three years, has resigned to become superintendent of the Sperry Gyroscope Company of Brooklyn, N. Y. Mr. Mills began his career with the Westinghouse company as a machine operator and finally became superintendent of the small industrial motor department.

THE EDISON ELECTRIC APPLIANCE COMPANY, INC., Hotpoint Division, Chicago, has announced to its distributers and customers that in order to assist the government further, because of the urgent requests to save paper, it will not distribute this season the special Christmas window decorations or line of coöperative materials. The company states that it will, however, supply its standard line of helps in limited quantities.

THE BOOTH-HALL COMPANY, manufacturer of electric furnaces, Chicago, has placed in successful operation during the past few months the following steel melting furnaces: West Michigan Steel Foundry Company, Muskegon, Mich., 3-ton basic-steel castings for naval gun carriages; Monroe Steel Castings Company, Monroe, Mich., 1½-ton acid-steel castings; Queen City Foundry, Denver, Col., ¾-ton basic-steel castings for the Emergency Fleet Corporation; New England Steel Castings Company, East Longmeadow, Mass., 1½-ton acid-steel castings. In addition to these furnaces, there is also a ¾-ton acid-lined furnace in operation at the plant of the Duriron Castings Company, Dayton, Ohio, used for experimental work in the manufacture of duriron, and a 1½-ton furnace at the Avery plant, Peoria, Ill., basic, used for the manufacture of tractor castings.

DWIGHT P. ROBINSON & COMPANY, INC., constructing and consulting engineers, New York City, is the name of a firm just formed by Dwight P. Robinson, a former partner of Stone & Webster in charge of their construction and engineering business. The associates of Mr. Robinson will be R. M. Henderson, in charge of construction; C. W. E. Clarke, mechanical engineer; R. A. Philip and D. L. Galusha, electrical engineers, and M. E. Thomas, structural engineer, together with a nucleus of a strong purchasing, accounting and steel construction organization. All of these men for many years have been engaged in large undertakings under Mr. Robinson's direction. In the past they have specialized in the economical and rapid execution of difficult projects and in the new work are prepared to construct, either from their own designs or from the designs of others, hydroelectric developments, steam-power plants, transmission systems, industrial plants, housing developments, steel and reinforced-concrete structures, electrification of steam-railway systems, and similar work in this general field. They will also carry on a general practice as consulting engineers, including the making of engineering and financial reports and appraisals.

Trade Publications

FUSE TESTER.—The Blake illuminated fuse tester is pictured and described in a recently issued leaflet of R. S. Blake, 230 South La Salle Street, Chicago.

COAL-STORAGE SYSTEM.—Catalog 38, from the R. H. Beaumont Company, Philadelphia, has for its subject the Beaumont drag scraper system used in the ground storage of coal.

TOOLS AND HANDLES. — Illustrated general catalog 25 of the Columbus Handle & Tool Company, Columbus, Ind., gives prices and brief descriptions of construction tools, linemen's tools and equipment, handles for various uses as well as tools for other purposes.

INSULATION MAINTENANCE. — The relation between renewing insulating varnishes and keeping motors out of repair shops is dealt with in a recent leaflet from the Dolph Manufacturing Corporation, 95 Liberty Street, New York City. The firm makes insulating compounds and varnishes.

CUTTING AND WELDING.—"Oxwelding and Cutting" is the title of a book from the Oxweld Acetylene Company, New York City, and is a manual of instruction for welding and cutting, giving the principles of electric welding and cutting and explaining fifty-four problems which an efficient operator should master.

ENGINES.—Belliss & Morcom, Ltd., of Birmingham, England, have issued through their Canadian representatives, Laurie & Lamb, 211 Board of Trade Building, Montreal, a pamphlet showing some of the Canadian installations of the Belliss double-acting self-lubricating engines for generator drive as well as citing advantages of these engines and giving tables of the revolutions, kilowatts and horsepowers of the two-crank compound and non-compound and the three-crank triple-expansion and compound types. The horsepower of the former ranges from 32 to 720, while the latter type of engines develop from 260 hp. to 2500 hp.

New Incorporations

THE BELYEA COMPANY of New York, N. Y., has been incorporated by W. P. Berryman, B. M. and T. S. Belyea, 48 East Eighth Street, New York City. The company is capitalized at $10,000 and proposes to manufacture electric and gas-operated machinery.

THE FULLER ELECTRIC COMPANY of New York, N. Y., has been incorporated by C. L. Thompson, W. A. Walling and E. L. Dolder, 315 East Seventh Street, New York City. The company is capitalized at $10,000, and proposes to manufacture electric vehicles.

THE CRAWFORD ELECTRICAL CONSTRUCTION COMPANY of New York, N. Y., has been incorporated with a capital stock of $5,000 to do a general electrical contracting business. The incorporators are J. Wolf, S. Berlinger and J. L. Diamond, 1789 Broadway, New York City.

THE FEDERAL STORAGE BATTERY COMPANY of Washington, D. C., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture storage batteries. The incorporators are M. E. Jones Rudolph Uramboug and Richard Bowen of Washington, D. C.

THE UNIVERSAL PRODUCTS COMPANY of Madison, Wis., has been chartered by John L. Bourke, John L. Newman and E. Lee, all of Madison. The company is capitalized at $50,000, and proposes to manufacture motor vehicles, tractors, machinery and install lighting and heating plants.

THE GERLINGER ELECTRIC STEEL FOUNDRY COMPANY of Milwaukee, Wis., has been incorporated with a capital stock of $99,000 by the owners of the Gerlinger Electric Steel Foundry Company, to control and operate the new electric steel foundry now being completed at Fifty-ninth and National Avenues, West Allis. The officers of the company are: William E. Gerlinger, president; George P. Gerlinger, vice-president, and C. A. Gerlinger, secretary and treasurer.

New England States

BOSTON, MASS.—Work has been resumed on the eight-story addition, 74 ft. by 167 ft., to the plant of the Gillette Safety Razor Company. The cost is estimated at about $500,000.

WATERTOWN, MASS.—Plans are being prepared by the Aetna Mills Company of Watertown for an addition to its plant, to cost about $50,000.

WORCESTER, MASS.—The Worcester Electric Light Company has applied to the City Council for permission to lay a conduit in South Crystal Street.

PHILLIPSDALE, R. I.—Plans have been prepared for the erection of a pumping station, 20 ft. by 20 ft., with an intake of 300 ft. 30-in. pipe line at the plant of the American Electrical Works.

NEW HAVEN, CONN.—The New York, New Haven & Hartford Railroad Company is planning to erect a new engine house at Hopewell, to cost about $50,000.

WATERBURY, CONN.—The Public Utilities Commission has given its approval of the construction of a transmission line of the Connecticut Light & Power Company from its substation at Bunker Hill in the town of Waterbury through the towns of Waterbury and Oxford to its hydroelectric power station on the Housatonic River.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Electric Power Corporation has filed a petition with the Public Service Commission asking for approval of operation of a high-tension transmission line between its substation at Amsterdam and Utica and one between Little Falls and Herkimer. Franchises have been received from the towns of Amsterdam, Johnstown, Ephratah, Oppenheim, Manheim and Little Falls. The company has a contract to furnish electricity to the Utica & Mohawk Valley Railroad.

BUFFALO, N. Y.—The City Council is considering replacing the gas lamps in many of the streets with electric lamps.

BUFFALO, N. Y.—The capital stock of the Clemens Electrical Corporation, 725 Main Street, has been increased from $10,000 to $100,000. The company manufactures electrical machinery and equipment.

NEW YORK, N. Y.—Plans are under consideration by the Public Service Commission for the early award of the remaining contracts on the dual rapid transit system, including the construction of four or more shop buildings for repair and general work. The cost of the work is estimated at about $25,000,000.

NEW YORK, N. Y.—Contract has been awarded by the New York Municipal Railway Company to the General Railway Signal Company of Rochester for the installation of alternating-current block signals and interlocking on its proposed underground line to be built in Sixtieth Street, New York City.

NIAGARA FALLS, N. Y.—Plans have been prepared by the Cliff Electric Distributing Company, Canal Basin, for the erection of four-story buildings, 20 ft. by 75 ft., at Echota, near Niagara Falls. The buildings, it is understood, will be used for substation work.

NIAGARA FALLS, N. Y.—Plans for the construction of a hydroelectric plant to develop approximately 200,000 hp. additional power, it is reported, have been submitted to the United States government by Dr. T. Kenard Thomson, 50 Church Street, New York City. The plans provide for the construction of a new dam across the Niagara River, 4 miles below the falls. The cost is estimated at $50,000,000. It will require about two years to carry out the project.

OGDENSBURG, N. Y.—Plans have been prepared by the New York Central Railroad Company for the erection of a mechanical coal-handling plant at Ogdensburg, to cost about $30,000. G. W. Kittredge, Grand Central Terminal, New York City, is chief engineer.

BOONTON, N. J.—The Morris & Somerset Company of Morristown has acquired the local plant of the Boonton Electric Company, including water rights along the Rockaway River in Boonton. Extensions and improvements, it is understood, will be made to the property.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

JERSEY CITY, N. J.—The City Commission has appropriated more than $200,000 to provide funds for the construction of a new power plant at the Lincoln High School, the installation of new boilers and auxiliary equipment at the Coles Street bathhouse and new boiler equipment at the City Hospital, in connection with the bond issue for $3,985,000, arranged to provide for various extensions and improvements at municipal properties.

BUTLER, PA.—The proposed new power plant of the Imbria Coal Company of Butler will be located at Nichola instead of Etnaria, as previously announced. The building will be about 40 ft. by 65 ft. and will cost about $10,000.

CARLISLE, PA.—Plans, it is understood, have been prepared by the Western Union Telegraph Company for the installation of a new underground conduit system to replace the present overhead lines.

CONNELLSVILLE, PA.—The Capson Glass Company has started work on the construction of a new gas-producer plant at its works, to cost about $100,000.

NICETOWN, PA.—Plans have been prepared by the Midvale Steel & Ordnance Corporation, Widener Building, Philadelphia, for the installation of new reinforced concrete oil and switch cells at its local plant.

PHILADELPHIA, PA.—Plans are under consideration by the Philadelphia Electric Company for extensive improvements and additions to its plant at Chester, including the installation of a new 30,000-kw. generating unit for the purpose of furnishing electricity to the shipbuilding works of the American International Corporation at Hog Island and in the Eddystone district. The directors of the company have authorized an issue of $4,997,550 in capital stock to provide funds for extensions to its system.

PITTSBURGH, PA.—Notice has been filed by the Electric Appliance Company of Pittsburgh of an increase in capital stock from $25,000 to $40,000, to provide for general business extensions.

SCOTDALE, PA.—The Electric Water Sterilizer & Ozone Company has filed a notice of an increase in capital stock from $250,000 to $350,000, to provide for extensions.

STATE COLLEGE, PA.—The light, heat and power plant of the Pennsylvania State College was recently damaged by fire, causing a loss of about $300,000. The entire engineering school with equipment was totally destroyed.

ALEXANDRIA, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 16, under Specification 3627, for furnishing and installing electric traveling cranes in the torpedo assembly building plant at Alexandria. The cost is estimated at about $30,000.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 9, under Specification 3483, for elevators for laundry and power house at Norfolk, Va.

WHEELING, W. VA.—The Wheeling Electric Company, it is reported, is considering the construction of a new steam-driven power plant, to cost about $2,000,000, in the vicinity of Windsor. The foundation Company of New York, N. Y., has charge of building operations.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 3527—miscellaneous flexible brush-holder cable, miscellaneous single-conductor ignition cable; Schedule 3534—miscellaneous lighting and power cable, miscellaneous ship-lighting cable, miscellaneous telephone cable, miscellaneous lighting and power wire, miscellaneous telephone wire, miscellaneous weatherproof wire; Schedule 3524—miscellaneous incandescent cord; Schedule 3519—miscellaneous brass wire, miscellaneous hard and soft copper wire, miscellaneous bronze phosphor wire; Schedule 3526—miscellaneous fuse wire, miscellaneous nickel steel bare resistance wire; Schedule 3523—miscellaneous underwriters' wire, Brooklyn, N. Y., Schedule 3534—25,000 ft. lead-sheathed cable; Schedule 3534—miscellaneous rubber-covered wire. Boston, Mass., Schedule 3527—500 ft. searchlight cable. Mare Island, Schedule 3534—250 lb. annunciator wire. Norfolk, Va., Schedule 3523—8000 ft. pot-head wire. Charleston, S. C., Schedule 3526—miscellaneous resistance ribbon wire. Application for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Eastern and Western yards, until Dec. 9, Schedule 7253½—connectors and outlet box for cable; Schedule 7261½—50 resistance devices. Boston and Brooklyn, Schedule 7275½—270 6-volt buzzers and 750 6-volt 3-in. bells. Gloucester, Schedule 7267½—six 3-hp. motors, one motor-generator set and one motor-generator. Puget Sound, Wash., until Dec. 13, Schedule 7255½—one switchboard. Bids will also be received as follows: Washington, Schedule 7268½—3450 transformers; Schedule 7350½—20 motor buzzer sets; Schedule 7356½—switchboard panels. Puget Sound, Schedule 7274½—two transformers; Schedule 7307½—miscellaneous soft lead wire; Schedule 7340½—two motors; Schedule 7346½—one 28-hp. motor; 7348½—one 50-hp. motor; Schedule 7349½—fuses and fuse elements. Brooklyn, Schedule 7305½—miscellaneous extension sockets. Eastern and Western yards, Schedule 7311½—miscellaneous storage batteries. Boston, Schedule 7333½—gasoline blowers and a number of 250-hp. motors. Fort Worth, Tex., Schedule 7339½—miscellaneous cable, 196 ft. busbar copper, miscellaneous busbar insulators and supports, six oil circuit breakers, four transformers, three switches and one lightning arrester. Pensacola, Fla., Schedule 7347½—miscellaneous receptacles, plugs, cable and connectors. Norfolk, Va., Schedule 7345½—switchboard. Application for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—Contract has been awarded by the Detroit Copper & Brass Rolling Mills, Clark Avenue, Detroit, to A. A. Albrecht, Penobscot Building, for an addition to its plant, to cost about $400,000.

CLEVELAND, OHIO.—The Reflex Ignition Company has acquired a site on West 106th Street, on which it proposes to erect a plant. The company manufactures spark plugs, etc.

CLEVELAND, OHIO.—The City Council is planning to erect a power house at East Fifty-third Street. The proposed plant will have an output of 10,000 kw., and will cost about $300,000. A bond issue has been approved by the Capital Issues Commission to finance this project.

CLEVELAND, OHIO.—Bids will be received at the office of purchase and supplies, City Hall, Cleveland, Ohio, until Dec. 13, for the forced-draft air ducts for the division of light and heat. Bids will also be received on the same date for high-pressure steam separators. Specifications may be obtained upon application to the office of the division of light and heat.

MASSILLON, OHIO.—A permit has been granted the Massillon Electric & Gas Company for rebuilding its plant, which was destroyed by an explosion last spring. The cost is estimated at $30,000.

NAPOLEON, OHIO.—The Detroit, Toledo & Ironton Railway Company has awarded contract to the Crowell-Lundoff-Little Company of Cleveland for the construction of an eight-stall engine house and machine shop at Napoleon, to cost about $80,000.

NEW LEXINGTON, OHIO.—The capital stock of the Perry County Telephone Company has been increased from $75,000 to $125,000. Extensive improvements are contemplated by the company.

ST. MARYS, OHIO.—Contract for excavation and concrete work for the new electric light plant has been awarded by the Board of Control to the Joseph Skeldon Engineering Company of Toledo. The contract for piping, wiring, installing machinery, etc., will not be awarded until the $20,000 bond issue has been sold, which may not be until the first of the new year.

GENEVA, IND.—Work has begun on the construction of the new power plant to be erected at the local factory of the Powers National Oil Company of Detroit.

INDIANAPOLIS, IND.—The Big Four Railway Company is planning extensions to its local roundhouse, to cost about $90,000.

SHOALS, IND.—The Shoals Light & Power Company, it is reported, is installing steam engines, replacing oil engines in its plant.

CHICAGO, ILL.—The Packard Motor Company, East Grand Boulevard and Belt Line, is planning to erect a service station on Twenty-fourth Street and Prairie Avenue, to cost about $750,000.

CHICAGO, ILL.—Plans are under consideration by the W. F. Hall Printing Company, 466 West Superior Street, for an addition to its plant on Superior and Kingsbury Streets, to cost about $675,000. Graver & Dinkelburg, 80 East Jackson Boulevard, are architects.

DIVERNON, ILL.—The municipal electric light plant was recently destroyed by fire, causing a loss of about $50,000.

EAST ST. LOUIS, ILL.—Armour & Company, Union Stock Yards, Chicago, are contemplating the construction of a power house in East St. Louis, to cost about $60,000.

FARMINGTON, ILL.—The Central Illinois Light Company is contemplating the erection of an electric transmission line from Farmington to Gilchrist, where it will connect with the transmission system of the Canton (Ill.) Gas & Electric Company. E. E. Corken of Peoria is secretary.

LINCOLN, ILL.—The City Commission has decided to build an extension of the Lincoln Municipal Railway to the North Mine.

MALTA, ILL.—The installation of a larger engine in the future in the municipal electric light plant is under consideration. S. S. Plapp is manager.

EAU CLAIRE, WIS.—The Wisconsin-Minnesota Light & Power Company, it is reported, is considering the construction of a power dam. It will probably be located at Chippewa Falls, Holcombe or Dunnville.

GRAFTON, WIS.—The Badger Rolling Mills, it is reported, are contemplating utilizing electric power.

STURGEON BAY, WIS.—The Sturgeon Bay Fruit Package Company is planning to erect an addition, 52 ft. by 90 ft., three stories, and extension to boiler and engine house, 26 ft. by 30 ft.

AUSTIN, MINN.—Contracts will soon be awarded by the city of Austin for coal-handling equipment, to cost about $12,000. The C. L. Pillsbury Company, Metropolitan Life Building, Minneapolis, is engineer.

MANKATO, MINN.—Three 400-kva. transformers are being installed at the local substation of the Northern States Power Company to provide for the increasing demands on the Kasota-St. Peter transmission line.

MINNEAPOLIS, MINN.—Plans are under consideration by the Minneapolis & St. Louis Railroad Company for the construction of a new terminal plant at Fort Dodge, including an engine house, machine shop, boiler plant and power house. Coal hoisting and handling machinery, turntable and other equipment will be installed. The company is also planning to remodel a shop in Marshalltown, at a cost of about $10,000.

HOLDEN, MO.—The Island Creek Coal Company is planning to install two 400-hp. boilers in its power plant.

KANSAS CITY, MO.—Contract has been awarded by the Kansas City Light & Power Company to the E. L. Winn Construction Company of Kansas City, for the construction of a substation, 50 ft. by 100 ft., to cost about $35,000. Sargent & Lundy, 72 Adams Street, Chicago, Ill., are engineers.

MARSHFIELD, MO.—Bonds to the amount of $15,000 have been voted for the purchase of the local electric light plant.

ST. LOUIS, MO.—The city of St. Louis is considering doubling the capacity of the new municipal dock. The cost of the work is estimated at $350,000, and will include the installation of mechanical loading and unloading equipment.

ST. LOUIS, MO.—The Board of Public Service is considering plans for repairing two wings of the old college building, recently damaged by fire, and to erect an additional building for the city infirmary, to cost about $100,000. E. R. Kinsey is president of the board.

WESTON, MO.—Improvements are contemplated to the municipal waterworks system, including the installation of new pumping equipment and other machinery. C. E. McCrae, Republic Building, Kansas City, Mo., is engineer in charge.

PRATT, KAN.—Bids will be received by the Board of Education of Pratt until Dec. 19, for construction of high-school building, including heating, electric wiring, plumbing, fan ventilating, etc. The cost of the building is estimated at $100,000. W. E. Hulse & Company of Hutchinson are architects.

Southern States

FREMONT, N. C.—Bonds to the amount of $25,000 have been authorized, the proceeds to be used for electric lighting and street improvements.

MURPHY, N. C.—The City Council is considering the construction of a hydroelectric plant. The cost is estimated at about $25,000.

ELLOREE, S. C.—Preparations are being made by the Elloree Electric Light Company for rebuilding its electric light plant, recently destroyed by fire. Machinery, it is understood, has been purchased. D. T. Evans is president.

SARASOTA, FLA.—Plans are under consideration by the City Council for the purchase of the electric plant of the Sarasota Ice & Electric Company. If taken over by the city, the system will be enlarged and improved.

TARPON SPRINGS, FLA.—Preparations are being made by the Florida Glass Company of Tampa for the erection of a new plant near Tarpon Springs. The cost of the plant, including equipment, is estimated at $150,000, and will include a main building, 150 ft. by 300 ft.; machine shop, 40 ft. by 75 ft., a forge and blacksmith shop, mixing department and other buildings.

TUTWILER, MISS.—Bonds to the amount of $8,000 have been authorized for the installation of a municipal electric light plant.

COTTER, ARK.—The Dixie Power Company is contemplating the construction of a hydroelectric power plant on the White River, to cost about $5,000,000. The plans include the construction of a dam, 2000 ft. long and 150 ft. high, across the White River, to develop about 60,000 hp., to be used locally for smelting and manufacturing purposes. The project is awaiting Congressional action.

CUSHMAN, ARK.—The White River Manganese Company, recently incorporated, is planning to develop 120 acres of manganese land. Mining equipment to be installed will cost about $55,000. Electric power will be used. B. B. McHam of Joplin, Mo., is superintendent.

ROGERS, ARK.—The Ozark Cider & Vinegar Company is planning to remodel its vinegar plant to be equipped with a complete bottling outfit, etc. It may install a power plant. The cost is estimated at $20,000. O. B. Phillips is manager.

MOORINGSPORT, LA.—The Oil City (La.) Electric Light & Power Company is planning extensions to its service in Mooringsport.

NEW ORLEANS, LA.—The Machinery Exchange Company, 4201 Bienville and David Streets, it is reported, would like to receive prices on two turbine-driven generators of 1000-kw. to 1500-kw. capacity.

NEW ORLEANS, LA.—Plans have been completed by the city of New Orleans for the construction of a coal-handling plant for loading steamships with cargo coal. A large storage bin connected by a system of conveyors with railroad and river barges and steamship wharf is included in the project. The United States Fuel Administration has given its approval of the work.

DUNCAN, OKLA.—Plans are being prepared for improvements to the electric light plant, waterworks and sewer system. A bond issue of $95,000, to provide funds for the proposed work, has been approved by the Attorney-General. The Benham Engineering Company, Colcord Building, Oklahoma City, has charge of the engineering work.

KINGFISHER, OKLA.—Preparations are being made for improvements to the municipal electric light plant and waterworks system, to cost about $50,000. Bids, it is understood, will soon be asked for material for transmission system. Black & Veatch, Inter-State Building, Kansas City, Mo., are engineers.

PONCA CITY, OKLA.—All bids submitted Oct. 23 for construction and equipment for waterworks and electric light plant for the city of Ponca have been rejected.

TULSA, OKLA.—New equipment, including engines, boilers, etc., will be installed in the refrigerating plant of the Independent Packing Company, 25 East Twelfth Street, Tulsa.

BAY CITY, TEX.—Preparations, it is reported, are being made by the Texas Gulf Sulphur Company for the development of sulphur mines, involving an expenditure of about $4,000,000. George Stockham Hessenbruch of Matagorda is manager.

CLIFTON, TEX.—The Clifton Ice & Cold Storage Company, it is reported, contemplates the construction of an ice and cold storage plant, to cost about $10,500.

DALLAS, TEX.—Steps, it is stated, have been taken by the City Commission for carrying out of the provisions of the new franchise granted the Dallas Railway Company for making important improvements and extensions to its street-railway system and for the construction of interurban railways. The proposed improvements for the street-railway system will involve an expenditure of about $500,000. Under the franchise the company must start the construction of two interurban railways, each to be not less than 30 miles in length, and make other expenditures amounting to $1,000,000. The carrying out of these provisions of the franchise were deferred on account of the war.

DONNA, TEX.—Additional bonds to the amount of $500,000 have been voted by the Donna Irrigation District for extensions of canals and ditches and the installation of additional machinery in pumping plant.

MARFA, TEX.—The Capote Nitrate Company, recently incorporated, is planning to mine and manufacture nitrate of potassium and sodium of nitrate. Alfred Dueller, G. C. Simpson and J. B. Berff, all of San Antonio, are interested in the company.

MARLIN, TEX.—The Marlin Grocery Company is reported to be contemplating the installation of a pumping plant on the Brazos River in Fall County to irrigate about 100 acres.

RANGER, TEX.—Plans are under consideration by the Chamber of Commerce for establishing an electric lighting system in Ranger.

UVALDE, TEX.—Arrangements are being made by the Uvalde Electric Light & Ice Company for extensions and improvements to its system. Contract for machinery, it is understood, have been placed.

WEATHERFORD, TEX.—Plans are under way for rebuilding the municipal electric light plant, recently damaged by fire.

Pacific and Mountain States

ANACORTES, WASH.—The City Council recently passed an ordinance providing for the purchase of the entire waterworks system of the Washington Power Light & Water Company.

MOLSON, WASH.—Plans are under consideration by Ward Brothers, owners of the local electric light plant, for the purchase of an electric generator and a gasoline engine, to be used as an auxiliary to the present steam plant.

PE ELL, WASH.—Work will begin at once on the erection of an electric transmission line connecting the property of the Central Light & Manufacturing Company at Pe Ell with the transmission lines of the North Coast Power Company at Meskill. The towns of Doty and Dryad will be benefited by the extensions as well as Pe Ell.

PILOT ROCK, ORE.—The local electric light plant was recently destroyed by fire. The plant was connected with a flour mill and furnished energy for the municipal lighting system.

GLENDALE, CAL.—The Southern California Edison Company has applied to the State Railroad Commission for permission to sell part of its local system to the city of Glendale.

LOS ANGELES, CAL.—Plans have been prepared by the Pacific Electric Railway Company for the erection of a substation, 30 ft. by 50 ft., at Maple Avenue and Seventh Street.

Canada

PORT ALBERNI, B. C.—The Town Council is considering the installation of an electric system, to cost about $60,000.

COBALT, ONT.—The Northern Ontario Light & Power Company is contemplating extending its transmission system to supply electricity in the Boston Creek mining district.

LONDON, ONT.—Plans are under consideration by the City Council for an addition to the municipal power station, to cost about $45,000. H. A. Brazier is engineer.

PORT ARTHUR, ONT.—The Electrical Manufacturing Company of Vancouver, B. C., has been awarded the contract for the power panels and cabinets for the complete equipment of the grain elevators under construction by the Saskatchewan Coöperative Elevator Company at Port Arthur.

MONTREAL, QUE. — A section of the plant of the Patterson Manufacturing Company, including the entire boiler room, was recently destroyed by fire, causing a loss of about $10,000.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Dec. 11, for copper, brass, bronze, tin, boilers, rope, cable, wire, watt-hour meters, electric fans, connectors, condulets and conduit, etc. Blanks and information relating to this circular (circular 1241) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

Directory of Electrical Associations

Printed in the First Issue of Each Month

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AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

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AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Fort Smith, Ark.

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FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Jacksonville, Jan. 5, 1919.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

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NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

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NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass. Annual meeting, Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M. Annual meeting, Albuquerque, N. M., Feb. 17-19, 1919.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

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OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary H. A. Lane, 611 State National Bank Building, Oklahoma City. Annual meeting, Feb. 13, 14 and 15, 1919, Oklahoma City.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

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SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

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VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Annual meeting, Chicago, Jan. 28-30, 1919.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill. Annual meeting, Chicago, January, 1919.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

1,282,295. FIRE-ALARM SYSTEM; Wilton S. Schuyler, Savannah, Mo. App. filed March 26, 1917. Especially designed for smaller towns and villages in which a fire bell is sounded.

1,282,493. OUTLET-BOX FITTING; George B. Thomas, Bridgeport, Conn. App. filed April 26, 1918. Pertains particularly to connection block to be associated with any one of a series of outlet fittings.

1,282,497. ELECTRICAL MEASURING INSTRUMENT; Harold E. Trent, Wilkinsburg, Pa. App. filed Nov. 19, 1914. Indicating or integrating wattmeter operating with permanent magnet and movable coil.

1,282,502. ELECTRIC WELDING MACHINE; Robert E. Wagner and Wesley E. Laid, Pittsfield, Mass. App. filed April 20, 1918. Particularly adapted for welding together metal sheets along an extended seam or line.

1,282,521. PROCESS OF AND APPARATUS FOR EXTRACTING METALS FROM ORES; Frank L. Antisell, Perth Amboy, N. J. App. filed Jan. 7, 1915. For leaching copper ore and electrolytically depositing its metal.

1,282,525. BINDING TERMINAL; Reuben B. Benjamin, Chicago, Ill. App. filed Feb. 20, 1916. Wiring can be quickly accomplished.

1,282,555. FLASHLAMP WITH EXTENSION; William A. Ericksen, Brooklyn, N. Y. App. filed April 24, 1918. Bulb is also adapted for use at some distance from battery.

1,282,565. ELECTRIC SWITCH OR SOCKET KEY; Frederick P. Gates, Hartford, Conn. App. filed Jan. 22, 1917. Having a shank of special form struck from sheet metal and formed to shape.

1,282,566. FUSE PLUG; Henry F. Goetz, Waterbury, Conn. App. filed May 6, 1918. Sheet-metal contacts of special construction employed whereby their correct seating in the plug body is assured.

1,282,578. ELECTRIC TIME SWITCH; Edmund G. Hoffmann, Burksville, Ill. App. filed Feb. 19, 1916. Capable of closing and breaking circuit at varying intervals to correspond with varying lengths of night during different seasons of year.

1,282,594. LAMP STAND; Max Kossmann, Brooklyn, N. Y. App. filed Feb. 18, 1918. Bulb can be adjusted to various positions.

1,282,606. REFILLABLE FUSE CARTRIDGE; Herbert Lutz, Hamilton, Ontario, Canada. App. filed April 23, 1918. Having contacts at outer or cap ends of casing.

1,282,615. FLASHLIGHT AND BATTERY; Moz Mizrahi, New York, N. Y. App. filed June 5, 1918. Casing made of cheap material such as strawboard or the like.

1,282,621. GRAPHIC METER AND THE LIKE; John A. Obermaier, Chicago, Ill. App. filed Oct. 13, 1917. Relates particularly to pen construction.

1,282,630. ELECTRICAL CONNECTOR; Thomas Rhodus, Chicago, Ill. App. filed July 9, 1917. For permanent attachment to line wire for connection in readily detachable manner to terminal posts of primary batteries of different makes.

1,282,653. CONNECTING POLE; William W. Thompson, Chicago, Ill. App. filed July 16, 1917. To make contact with an aërial wire.

1,282,660. MANUFACTURE OF STEEL; Samuel S. Wales, Pittsburgh, Pa. App. filed Aug. 3, 1917. Has particular relation to manufacture of steel in electric furnaces at small or isolated plants where molten metal is not available for use.

1,282,676. LAMP SUPPORT; William J. Carlin, Roxbury, Mass. App. filed Sept. 21, 1917. Rays from lamp may be thrown in every possible direction.

1,282,684. CORE CONSTRUCTION FOR ELECTRICAL APPARATUS; Edgar C. George, Norwood, Ohio. App. filed Feb. 19, 1917. For promoting efficient ventilation of cores while maintaining strong and durable construction.

1,282,694. AUTOMOBILE SIGNAL; Sam Illingworth, Dallas, Tex. App. filed July 6, 1917. For indicating proposed movements of automobile.

1,282,760. TESTING APPARATUS FOR SPARK COILS, PLUGS, ETC.; Charles T. Cole Roundup, Mont. App. filed Feb. 24, 1917. Apparatus contained within carrying case and so easily transportable.

1,282,803. SIGNALING SYSTEM; William A. Fricke, Chicago, Ill. App. filed Aug. 25, 1914. Used in connection with ordinary telegraph line circuit, so that if station signaled cannot be raised by regular code call, special device will be operated to signal desired station.

Record of Electrical Patents

Notes on United States Patents

1,282,815. ELECTRIC SNAP SWITCH; Monroe Guett, Hartford, Conn. App. filed Sept. 12, 1916. Binding preventing snap movements is eliminated.

1,282,816. ELECTRIC SNAP SWITCH; Monroe Guett, Hartford, Conn. App. filed Jan. 24, 1918. To assure adequate insulation between parts on supporting body and face plate.

1,282,828. AUTOMATIC SLOW-DOWN CONTROLLER; Clark T. Henderson, Milwaukee, Wis. App. filed April 29, 1914. For variable-speed motors.

1,282,835. AUTOMATIC CUT-OFF; John G. Homan, Steubenville, Ohio. App. filed July 18, 1917. If thermostat connected to the apparatus fails to break circuit at rise in temperature, the cut-off will be freed.

1,282,836. MOTOR CONTROLLER; Albert J. Horton, White Plains, N. Y. App. filed Jan. 2, 1918. For both field-regulating and stopping purposes and to obviate using either special stopping switch or special current-reducing means.

1,282,842. STARTING BOX; Robert A. Ilg, Chicago, Ill. App. filed July 22, 1916. Has reference to relation between starting arm and release member.

1,282,855. MOTOR-CONTROL SYSTEM; Walter C. Kennedy, Milwaukee, Wis. App. filed March 7, 1916. Means responsive to current variations in motor circuit for selectively regulating field of generator and field of motor in accordance with action of motor, i. e., as motor or as generator.

1,282,876. LINE-CONDUCTOR SUPPORT; William D. Kyle, Milwaukee, Wis. App. filed Oct. 23, 1916. Combined insulator and supporting bracket with universal joint.

1,282,891. ROTARY FIELD MAGNET WITH PARALLEL GROOVES FOR THE WINDINGS; Fredrik Ljungstrom, Finspong, Sweden. App. filed April 16, 1915. In Lamme type rotator centrifugal strain is lessened.

1,282,892. TREATMENT OF COPPER ORES; Alfred A. Lockwood, Forest Hill, England. App. filed Jan. 20, 1917. Copper may be precipitated directly from pulped ore without filtration.

1,282,933. ELECTRIC OVEN; Leroy K. Pontius, Chicago, Ill. App. filed Dec. 13, 1915. Heating unit includes a core which surrounds oven proper.

1,282,954. STEERING-COLUMN SWITCH UNIT; Richard C. Scaife, Cleveland, Ohio. App. filed Aug. 27, 1914. Controlling apparatus for starting and lighting system of motor vehicle.

1,282,956. MANUFACTURE OF WINDINGS FOR ELECTRICAL MACHINES; Gustav Schongut, Budapest, Hungary. App. filed March 11, 1915. Machine draws wire into windings.

1,282,965. TELEPHONE SYSTEM; Frank M. Slough, Elyria, Ohio. App. filed Nov. 12, 1914. To produce cut-off device which will under no circumstances respond to ringing current until subscriber has responded to bell ringing.

1,282,966. TELEPHONE SYSTEM; Frank M. Slough, Elyria, Ohio. App. filed Nov. 12, 1914. Relates to systems where ringing of subscriber is automatically continued until he responds.

1,282,969. ELECTRICAL STARTING SYSTEM FOR INTERNAL-COMBUSTION ENGINES; Cyril A. Soans, Chicago, Ill. App. filed Nov. 7, 1913. To form part of power system of motor vehicle.

1,283,002. SIGNAL; Albert M. Ward, Rochester, N. Y. App. filed March 6, 1918. All signaling elements are mounted upon a single base, and one electromagnet is employed for operating plurality of signaling elements.

1,283,005. BATTERY AND METHOD OF MAKING SAME; Henry Wilhelm and Harold Olaneta, Brooklyn, N. Y. App. filed Aug. 10, 1917. Paste surrounding the cartridge of dry battery is cooked prior to being placed in cup.

1,283,046. STARTING DEVICE FOR EXPLOSION AND OTHER ENGINES; William J. E. Beere, London, England. App. filed Sept. 21, 1915. To provide against motor being revolved before it is in driving engagement with the engine.

1,283,054. CARBURETOR-HEATING DEVICE; William J. Biegel, New York, N. Y. App. filed Feb. 18, 1918. To be applied to any type of bowl without altering or modifying latter.

1,283,077. ELECTROLYTIC PRODUCTION OF ZINC; Galen H. Clevenger, Palo Alto, Cal App. filed May 7, 1917. Accomplished by leaching or extracting zinc ores, concentrates or other zinc-containing materials from zinc-sulphate solutions.

1,283,078. ELECTROLYTIC RECOVERY OF ZINC; Galen H. Clevenger, Palo Alto, Cal. App. filed May 7, 1917. Relates to recovery of zinc from ores and electrolytes containing small amounts of cobalt.

1,283,137. ELECTRIC HEATING DEVICE; Elbert Fowler, Atlanta, Ga. App. filed Dec. 10, 1915. Generates and reflects heat upon small objects contained therein and can be held in the hand for observation.

1,283,147. TYPEWRITING-TELEGRAPH SYSTEM; Frederick Ghio, Bristol, Conn. App. filed March 9, 1918. Only two line wires used to connect sending and receiving stations.

1,283,176. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Oct. 6, 1915. To vary automatically regulating effect of phase advancer in accordance with slip of induction motor to be governed.

1,283,182. AUTOMATIC DISTRICT TELEPHONE SYSTEM; Harry E. Hershey, Whitewater, Kan. App. filed Aug. 8, 1914. To provide improved trunking apparatus for establishing connection between lines.

1,283,200. WATER-LEVEL ALARM FOR DROP PLANS; Charles C. Johnson, Newburgh, N. Y. App. filed July 20, 1917. May be attached to refrigerator without interfering with removal of pan.

1,283,206. ELECTRIC SIGN FLASHER; Joseph A. Karpel, New York, N. Y. App. filed May 14, 1917. To prevent burning out of contacts by arcing.

1,283,226. CIRCUIT CONTROLLER; Richard C. Leake, Rochester, N. Y. App. filed May 29, 1916. Relates to circuit controllers having intermediate position and two operating positions.

1,283,236. OBTAINMENT OF GOLD AND SILVER FROM THEIR ORES; Alfred A. Lockwood, Forest Hill, England. App. filed March 8, 1918. Gold and silver to be precipitated directly from a pulped ore without filtration.

1,283,260. THERMOSTAT; Herbert D. Montgomery, Brooklyn, N. Y. App. filed Feb. 21, 1917. For use in automatic fire-alarm systems.

1,283,285. LABORATORY FURNACE; Carl A. Pfanstiehl, Highland Park, Ill. App. filed July 17, 1916. Equipped with heating, cooling, electrical and mechanical devices.

1,283,292. DRY-CELL BATTERY; Isaiah Pletcher, Iuka, Ill. App. filed March 13, 1918. Impregnating solution for recharging dry-cell batteries.

1,283,300. VEHICLE SIGNAL; Fritz G. Rantzau, Spokane, Wash. App. filed July 30, 1917. Oscillating arm for use on front portion of automobile.

1,283,304. TELEPHONE RECEIVER; Thomas Rhodus, Chicago, Ill. App. filed Dec. 16, 1916. Sectional formation of parts permits lighter construction.

1,283,314. AUTOMOBILE TRAFFIC SIGNAL; William Rosen, Middletown, Conn. App. filed Dec. 22, 1917. Audible means provided for calling attention to visual direction signal.

1,283,320. TELEGRAPHIC SENDING MACHINE; Ferdinand S. Ruttmann, New York, N. Y. App. filed June 2, 1914. Line circuit is automatically opened and closed through a manually operative keyboard mechanism.

1,283,329. ELECTROMAGNETIC APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Nov. 4, 1914. Differentiates between fluctuating or alternating currents of different frequencies, or between fluctuating or alternating current and continuous or direct current.

1,283,339. ELECTRICAL CONNECTION AND BOX; Frederick F. Skeel, Chicago, Ill. App. filed July 27, 1914. For use with conduit outlet boxes and in connection with meters.

1,283,340. ELECTRICAL CONNECTION AND BOX; Frederick F. Skeel, Chicago, Ill. App. filed Aug. 7, 1914. Particularly applicable for use with meters.

1,283,353. CONTROL SYSTEM; Norman W. Storer, Pittsburgh, Pa. App. filed Sept.

10, 1915. For four-motor equipment on electric railway cars or locomotives.

1,283,370. SELECTIVE DIRECTION INDICATOR FOR VEHICLES; Paul W. Vanderhoff, Topeka, Kan. App. filed Feb. 27, 1917. Indicators mounted in front and rear.

1,283,373. CASING FOR FLYWHEEL MAGNETOS; Harry R. Van Deventer, Sumter, S. C. App. filed April 21, 1917. Is stationary and also dustproof and waterproof.

1,283,380. CAR-LIGHTING SYSTEM; Leonard A. Watson, New York, N. Y. App. filed June 14, 1916. Electric controlling means to govern automatically charging current delivered to battery.

1,283,388. ELECTRIC BELL; Daniel G. Williams, Taunton, Mass. App. filed July 20, 1917. Tapper of bell has an isochronal movement to produce even and uniform resonance of gong.

1,283,400. TRUNK CIRCUIT; Hiram D. Currier, Chicago, Ill. App. filed June 11, 1915. Relates to telephone systems in which calls are extended from calling substation through operator's cord and trunk circuits to called substation.

1,283,413. TELEPHONE-EXCHANGE SYSTEM; Alexander E. Keith, Chicago, Ill. App. filed Jan. 22, 1907. Relates particularly to automatic systems operated on the district system principle.

1,283,418. TROLLEY HARP AND SHOE; John Miller, Jr., Amesbury, Mass. App. filed Aug. 14, 1916. Sliding trolley shoes equally efficient in forward or rearward travel on wire.

1,283,430. APPARATUS FOR CONVERTING RECIPROCATING MOTION INTO CONTINUOUS ROTARY MOTION; Henry E. Warren, Ashland, Mass. App. filed Nov. 30, 1914. For directly transferring motion.

1,283,431. ELECTRIC CLOCK SYSTEM; Henry E. Warren, Ashland, Mass. App. filed Aug. 21, 1916. Time indication may be distributed by means of alternating-current system.

1,283,433. SELF-STARTING SYNCHRONOUS MOTOR; Henry E. Warren, Ashland, Mass. App. filed Feb. 5, 1917. Synchronizing element is removed from maximum influence of magnetic field when rotor is at rest and is brought under maximum influence when rotor element substantially reaches synchronous speed.

1,283,434. TIMING DEVICE; Henry E. Warren, Ashland, Mass. App. filed Feb. 26, 1917. Directly and continuously driven by self-starting synchronous motor capable of starting and stopping substantially in an instant and of running continuously at a uniform speed.

1,283,435. SELF-STARTING SYNCHRONOUS MOTOR; Henry E. Warren, Ashland, Mass. App. filed Sept. 19, 1918. To be produced and operated at a minimum expense.

1,283,440. HEATING APPLIANCE; Edwin N. Lightfoot, New York, N. Y. App. filed Nov. 15, 1915. Electric soldering iron is free from soldered joints.

1,283,445. HIGH-CROSSING BELL FOR RAILROAD SERVICE; Eugene W. Vogel, Oak Park, Ill. App. filed May 27, 1914. Solenoid-type operating mechanism is protected against injury from rain, dust and the like.

1,283,466. ELECTROMECHANICAL SWITCH; Clarence N. Cahusac, Jersey City, N. J. App. filed April 2, 1917. For use with recorder for machines.

1,283,491. COMBINATION PORCELAIN SOCKET; Edgar H. Freeman, Trenton, N. J. App. filed April 11, 1917. Key socket may also be tapped for supplemental uses.

1,283,492. ELECTROSTATIC MACHINE; Walter S. Frost, Homerton, London, England. App. filed March 8, 1918. For use in electrical ignition systems of gas, petrol and internal-combustion engines.

1,283,507. THERMOSTATIC TEMPERATURE-CONTROLLING DEVICE FOR ELECTRIC OVENS; Frederic T. Harding, St. Paul, Minn. App. filed Jan. 13, 1917. To cut out and cut in an electric circuit automatically and to change the operating temperature as desired.

1,283,534. DYNAMO; Henry Leitner, Tunbridge Wells, England. App. filed Jan. 22, 1915. For regulating the output of dynamo machines designed to be driven at variable speeds.

1,283,563. CONTACT BANK; John G. Roberts, Dobbs Ferry, N. Y. App. filed Nov. 3, 1917. For electric switches having brushes movable in two directions at right angles to each other.

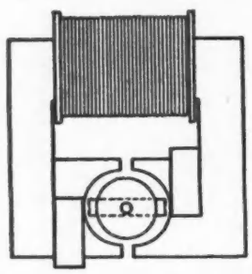
1,283,566. POCKET FLASHLIGHT; Francis M. Rosenfeld, New York, N. Y. App. filed Jan. 6, 1916. Circuit-closing device will operate equally well irrespective of way in which battery has been inserted in casing.

1,283,574. CONDUIT TERMINAL; August G. F. Schuster and Iver R. Johnson, Chicago, Ill. App. filed Dec. 11, 1915. More particularly adapted for use upon upper end of upright wire or cable conduit pipes such as are usually attached to upright supporting poles used in current-conducting system.

1,283,598. PROCESS OF CONCENTRATING NITRIC ACID; Bruno Thomas, Seattle, Wash. App. filed July 24, 1917. Absorption of gases is increased by use of pressure and concentration and purification is increased by electrolysis.

1,283,603. TELEPHONE SYSTEM; Richard I. Utter, Chicago, Ill. App. filed June 18, 1914. To provide a universal cord circuit and trunk circuit which may be used interchangeably with telephone systems of automatic or manual type.

1,283,645. ELECTRIC SWITCH; Carl Bramming, Chicago, Ill. App. filed Oct. 20, 1916. Of push-button type and primarily intended for automobile service.



1,283,433.—Self-Starting Synchronous Motor

1,283,651. LIGHTNING ARRESTER; Sutton R. Buchanan, New Bremen, Ohio. App. filed April 22, 1918. Particularly for use as a protection for low-potential telephone lines against lightning or other destructive high-potential currents.

1,283,660. THERMOSTATIC FIRE ALARM; Harry H. Camp, Spencer, W. Va. App. filed Jan. 4, 1918. Relates particularly to thermostatic member for use with electrical alarms of fire and other types.

1,283,669. HOOD-LOCKING DEVICE FOR AUTOMOBILES; Herbert H. Chrisman and Frank W. Adsit, Minneapolis, Minn. App. filed April 7, 1918. To prevent any unauthorized person from obtaining access to the engine.

1,283,670. STORAGE-BATTERY VENT; Christian A. Christiansen, Cleveland, Ohio. App. filed May 3, 1916. Will permit use of maximum amount of electrolyte in jar without trapping gases.

1,283,682. ELECTRIC SWITCH; Herbert W. Crane, Chicago, Ill. App. filed Aug. 16, 1917. Three-way solenoid switch which may be operated by successive movements of switch blade in same direction.

1,283,687. SIGNALING SYSTEM; Leo H. Darrow, New York, N. Y. App. filed Oct. 30, 1917. Relates to equipment for private branch exchange switchboards with which are associated both long-distance and local lines.

1,283,715. ELECTRIC WELDING; Charles H. Florandin and Alan M. Bennett, Westfield, N. J. App. filed Jan. 10, 1917. Means for regulating the voltage in accordance with the current and voltage conditions of the wire.

1,283,748. AUTOMATIC CONTACT-MAKING DEVICE FOR AN ELECTRIC CIRCUIT; Robert C. Harris, Indianapolis, Ind. App. filed July 27, 1917. To use a separate insulated circuit of wires, instead of the present track circuit used in railroad signaling.

1,283,754. PROCESS OF MAKING A HEAT-INSULATING COMPOSITION; Frank A. Headson, Milwaukee, Wis. App. filed Jan. 22, 1917. Consists in calcining finely divided diatomaceous earth and finely divided asbestos, intermixing and moistening the ingredients.

1,283,779. STORAGE BATTERY; Miller R. Hutchison and Charles W. Norton, West Orange, N. J. App. filed May 23, 1914. To provide improved battery structure of simple arrangement and construction especially designed for batteries having a great capacity and a high rate of discharge.

1,283,789. INDICATING AND RECORDING MECHANISM; Austin C. Johnson, Chicago, Ill. App. filed May 18, 1914. For giving a visual indication and, if desired, making a permanent record of the performance of one or more machines.

1,283,801. HEADLIGHT CUT-OUT; Horace L. Kincaid, Athens, Ala. App. filed July 28, 1917. For use upon automobiles having electric lamps supplied in series with electrical energy derived from a magneto or generator driven by engine operating the automobile.

1,283,804. OUTLET-BOX COVER; Philip Klein, Brooklyn, N. Y. App. filed Dec. 13, 1917. Having reliable means for securing cover to box.

1,283,806. ILLUMINATED NAME PLATE; Joseph F. Kreger, Erie, Pa. App. filed Jan. 15, 1918. For use in hallway and having electric means for illuminating the plate when it is desired to read the name thereon.

1,283,825. MAGNETIC CLUTCH; Albion D. T. Libby, East Orange, N. J. App. filed April 12, 1913. Particularly adapted for clutching driving mechanism to driven mechanism after the former has been started and has obtained a certain momentum.

1,283,827. ELEVATOR; David L. Lindquist, Yonkers, N. Y. App. filed Dec. 1, 1915. Automatic means for effecting exact landing at a predetermined point or points regardless of the load and speed of the device.

1,283,831. SELECTING SWITCH; Frank A. Lindquist, New York, N. Y. App. filed Aug. 2, 1916. Single operating magnet controls both rotary and longitudinal movements of brush-carrying element and a slow releasing magnet to control sequence of these movements.

1,283,845. ELECTRIC COMBINATION LOCK; Harry A. Marchant, Stoneham, Mass. App. filed Sept. 17, 1917. Electric circuits controlling lock must be opened, closed or modified in a predetermined manner in order to operate or permit the operation of the lock.

1,283,848. INCANDESCENT ELECTRIC LAMP; Victorino Martinez, Havana, Cuba. App. filed June 4, 1917. Only metallic part of device is that of the two contacts required for the passage of the electric current to the filament.

1,283,894. AUTOMATIC SWITCH; Osvald E. Rasmusen, West Hoboken, N. J. App. filed Sept. 22, 1916. Mechanical means permit the construction of an automatic switch having but a single operating magnet.

1,283,936. ILLUMINABLE DARNING LAST; Edna C. Smith, Clifton Forge, Va. App. filed April 11, 1918. Constructed of translucent or transparent material detachably secured to handle, which has a source of electric energy.

1,283,946. TROLLEY; Herman L. Stanley, Derby, Conn. App. filed June 29, 1917. Having contact bar for sliding engagement with the wire.

1,283,973. METHOD OF ELECTROPLATING; William Thum and John J. Mulligan, East Chicago, Ind. App. filed July 31, 1918. Relates to electroplating surfaces of base metals belonging to the more electro-positive series of metals with metals belonging to the more electro-negative series.

1,283,979. REGENERATIVE BRAKE DEVICE; Walter V. Turner, Wilkinsburg, Pa. App. filed June 30, 1917. Means operated upon apply brakes by fluid under pressure for cutting regenerative brake out of action.

1,283,981. ELECTROPNEUMATIC BRAKE; Walter V. Turner, Wilkinsburg, Pa. App. filed Sept. 14, 1917. Magneto having rotating armature employed.

1,283,983. SIGNAL FOR VEHICLES; Joseph C. Udell, Flint, Mich. App. filed April 18, 1917. To indicate intended change, such as turning in either direction or stopping.

1,283,989. RAIN SIGNAL; August F. W. Viehweger, Hoboken, N. J. App. filed Oct. 25, 1916. Casing formed of a single piece of sheet metal.

1,284,025. SPARK-PLUG CONNECTOR; Walter Zielinski, Bay City, Mich. App. filed April 9, 1918. To provide a firm yet readily detachable connector.

1,284,026. RELAY; Conrad H. Zierdt, Edgewood Borough, Pa. App. filed Feb. 20, 1917. Is selective as to frequency for contact operation, such selection being obtained by a single core and a single vane.